

A NEW
TREATISE
ON THE
GLAUCOMA,
OR
CATARACT.

K BY
SILVESTER O'HALLORAN, of Limerick,
SURGEON.

*Veniet tempus, quo, ista quæ nunc latent, in lucem dies
extrahet.*

SENECA.

Unius labor, multorum laborem allevat.

D U B L I N :

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M DCC L.

A. NEW

TREATISE

ON THE

GLAUCOMA,

OR

CATARACT.

BY

GEORGE O'BRIEN, Esq. of Lincoln's Inn.

STATIONER.



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MDCCLXXV.

DEDICATION.

Richard Mead, Esq;

OF THE

COLLEGE of PHYSICIANS,

London;

Fellow of the *Royal Society,*

&c.

LEARNED SIR,

I is a Complaint made
by the judicious *Heister*,
that few People attend to
the Study of the *Eye*, or
it's Disorders, with the At-
tention

DEDICATION.

tention which so delicate a Subject requires ; tho' certainly the most entertaining for Speculation, and the most useful with respect to Practice. But various things have concurred to discredit this Study ; the uncertain Method of treating those Disorders ; the various Sentiments of Authors, on the Seat and Nature of a *Cataract* ; their confus'd Differences between it and the *Glaucoma* ; and the very few regular *Surgeons*, who
have

DEDICATION

have publickly professed any Knowledge of it, have all together heaped such a Load of Calumny on it, that it seemed dangerous for any one, mindful of his own *Character*, to make any Attempt, to rescue it from the many Injuries it lay under. Yet have there of late Years appeared Persons, who, more regardful of the Honour of *Medicine*, than of the private Insinuations, and Slanders of some of the Professors of it, have dared to shew,

them

A 2

the

DEDICATION.

the true Causes and Cures
of the Disorders of this beau-
tiful and most useful Organ;
amongst whom, we must,
with Honour, mention, a
Petit, a *Brisseau*, and a *Ran-*
by.

BUT tho' these generous
Attempts, had caused the
Diseases of the Eye, to be
more particularly regarded,
by *Physicians* and *Surgeons*,
yet did there still remain Dif-
ficulties almost insurmount-
able, to the entire clearing
them

DEDICATION.

them up, and particularly
the *Cataract*. This bold
Task I have attempted, tho'
a laborious Work, and worthy
of *a better Pen*! I had the
Honour of laying it before
You, soon after my quitting
Paris, tho' then almost in
it's Infancy ——— You, SIR,
were pleased to think the At-
tempt laudable, and the Per-
formance not unworthy pub-
lick Notice. The Counte-
nance of a Gentleman, de-
servedly the Head of his Pro-
fession, and the *Hippocrates*
of

DEDICATION.

of the present Age, could
not but raise a strong Desire
in me really to merit Your
Esteem. Spurred on by this
Principle, I have with incre-
dible Labour and Perseve-
rance, pursued the Attempt;
and found, however beaten
the Subject, my Pains am-
ply rewarded by the Disco-
veries I have made.

But tho' the Approbation
of a College of Physicians,
would no Way raise the Es-
teem of such a Thing in
You;

DEDICATION.

You; as being Yourself a thorough Judge of Merit; yet it would certainly make the World, look with more Deference on such a Performance. It was on this Account, that I laid the Manuscripts before Dr. Barry, President of the College of Physicians, for their Examination, who had been previously acquainted of it, by Letter, from one of the Censors, and my honoured Friend. But tho' it remained there for above a Week, and

DEDICATION.

and that there had been a full Assembly of that learned Body, in the *Interim*, before whom I proposed to demonstrate the Facts herein contained; yet I found they had *neither Time, nor Curiosity* *, to see those Things; and they declined approving of it, because looking over the Authors here quoted, would take up too much Time. Thus much I thought proper to insert, in my own Defence. But it is certain,

* *Hequet's Answer to Dr. Petit's Letter.*

DEDICATION.

tain, that a good Performance needs not Commendation; and a bad one, ushered in with how pompous an one soever, will not be sufficient to protect it. The Truth of the latter Part of this Assertion, those Gentlemen can attest, and the former needs no Proof.

BUT tho' I had not the Pleasure of their Approbation, yet I doubt not, but the Attempt I have made, to rescue so valuable a Branch of

[B]

Physick,

DEDICATION.

Physick, from the Hands of
Empiricks, will meet with
the Applause of every *Physician* and *Surgeon*. Your
kind Acceptance and Protection of it, will be my
greatest Honour, and a sufficient Guard, from the
Snarlings of invidious *Criticks*. I have the Honour
to be, with great Respect,

SIR,

Your most Obedient
Humble Servant,

Limerick, Jan.

10. 1749.

SIL. O'HALLORAN.

C A T A L O G U E

O F

B O O K S,
Made Use of in the follow-
ing TREATISE

A.

ACTA Medico-physica Natur.
Cur.

L'Academie Royale des Sci-
ences, les Memoires.

Aquependente, Traité de la Chirur-
gie.

Arculanus in Rhafin.

a.

Boyle's

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B.

Boyle's Philosophical Works.
Borrichius, de sapientiâ Ægyptorum.
Briggii Ophthalmographia.
Brisseau, Traité de la Cataracte.

C.

Camper Dissertatio Medico-physica,
&c.
Cartesii opera.
Celsus, de re medica.
La Charriere, sa Chirurgie.
Cheseldon's Anatomy.

Philosophical Transac-
tions.

D.

Dionis Cours de Chirurgie.

E.

Edenburgh, Medical Essays.

Friend,

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F.

Friend, Historia Medicinalis.

G.

Gravensend's Mathem. Elem. N. P.

Gassendi opera.

H.

Harvey, de sanguinis circulat.

Heisterus de Cataractâ & Glauco.

—— Apolog. Tractat. Chirurg.

Hecquet, sur l'utilité de la saignée,
&c.

Hovius, de circul. humor. motu in
oculis.

Hugenii Dioptrics.

I.

Journal des Savans.

Jesús, Hali opera.

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Kepler

IV. CATALOGUE.

K.

Kepleri Dioptrices.

L.

Lemnius, de Miraculis Naturæ.

Lître, Memoires de l'Academie.

Le Cat, Traité des Sens.

Le Dran, sur les différentes manieres
de tirer la pierre, &c.

Lewenhoeck, Philosophical Trans-
actions.

M.

Martin's Opticks.

O Mara, Examen Diatribæ Thomæ
Willisii.

Mery, Memoires de l'Academie.

— sur la maniere de tailler de
Frere Jaques.

Mayernia, Præxeos Med.

Molyneux, Philosophical Trans-
actions.

Morand, Memoires de l'Academie.

Newton's,

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N.

Newton's, Sir Isaac, Opticks.

O.

Oribasius Sinops Med.

P.

Palfin, l'Anatomie Chirurgicale.

Petit, Physician, Memoires de l'Academie.

—— Letre des reflexions, &c.

—— sur la vray situation du
Cryftalin.

Petit, Surgeon, Memoires de l'Academie.

Plempii Ophthalmograph.

Porterfield, Medical Effays of Edinburgh.

Pemberton, Differtat. Medic. phys.

Ranby,

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R.

Ranby, Philosophical Transactions.

Riverii Praxis Med.

——— Observat.

Rolfoncius.

Read, on Disorders of the Eye.

Ruyfchii Thesaur. Anatom.

Rohaulti Physic.

Renault's Entretiens physiques.

St. Yves, les Maladies des Yeux.

Scheuchzer, Acta Medic. physic.

Smith's Opticks.

Taylor, le Mechanisme du Globe
de l'œil.

——— Syllabus of Disorders of the
Eye.

Winflow,

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W.

Winflow, Exposition Anatomique.

——— Mémoires de l'Academie.

Widelius, de Cataractâ.

Woolhouse, Dissertations savantes
& critiques, sur la Cataracte,
&c.

It is a luxurious Way of living, was the Rise, and is the Continuance, of so many Disorders, to which People are daily exposed, as Boerhaave has justly remarked; Temperance, and an abstemious Way of living, may certainly help to lessen them. But this Doctrine will hold good in other Disorders, yet it will never answer in those of the Eye, seeing that the

A PRE

Poor

CATALOGUE VII

W.

Winnow, Exposition Anatomique
Memoires de l'Academie
Widelin, de Cataracta
Woolhouse, Dissertationes de
et critiques sur la Catarrhe
etc.

A. P. R.

P R E F A C E.

IF a luxurious Way of living, was the Rise, and is the Continuance, of so many Disorders, to which People are daily exposed, as Seneca has justly remarked; Temperance, and an abstemious Way of living, may certainly help to lessen them. But tho' this Doctrine will hold good in other Disorders, yet it will never answer in those of the Eye; seeing that the

b

Poor

x P R E F A C E.

Poor are equally, if not more exposed to them than the Rich. It is, perhaps on this Account, that the Eye has seemed always to draw a more particular Attention from medical Writers. Even from the Times of Hippocrates, it has been handled with particular Exactness. Nay some imagine (1) that the Operation of a Cataract was known to the Egyptians above three thousand Years ago; seeing that Herodotus says, that Cambyles sent an eminent

(1) Borrichius de sapient. Ægypt. p.

205.

Heisterus de Cataractâ, p. 286.

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eminent Oculist of Egypt,
into Persia, to cure Cyrus.

Celsus, who was certainly
no great Anatomist, has de-
scribed the Cataract so ex-
actly, and it's Operation so
well (2), that what has been
since writ on that Subject,
has been little better than
a bare Transcription of his
Words; and nevertheless he
flourished in the Times of
Tiberius, that is, immediate-
ly after the Birth of Christ.

Aetius was still more exact
in his Description of the
b 2 Disorders.

(2) Lib. vii. cap. vii.

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Disorders of the Eye. Hippocrates and Celsus number about thirty Disorders incident to this Organ, as the learned Friend (3) observes; and Galen a few more; but this Writer recites above twice that Number of Diseases; and their Symptoms and Cure, he very accurately describes; and of which above thirty require manual Operations. Amongst the Greeks, next after Aetius, Paulus and Alexander certainly writ the best on those Disorders.

But

(3) *Histor. Medicinæ*, p. 139, 219.

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But the Arabians brought the Knowledge and Cure of those Disorders into much greater Perfection. Rhasis who practised Physick with great Applause at Bagdad, or Babylon, about the Year 900, wrote several learned Treatises; and in particular, in his Ninth Book, De Curatione omnium Partium, he treats very largely of the Diseases of the Eye. In his Eighteenth Chapter, he discourses of the Opthamia, and the different Species of it: In this Chapter also, he gives a just, tho' concise Anatomical Description of

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of the Eye; and particularly takes Notice of the Tunica Aranea, which surrounds the Cryſtalin-Lens. In the Thirtieth Chapter, he gives a large Account of the Cataract, and it's Cure; and deſcribes the Operation with great Exactneſs; directing the Needle to perforate the Eye, about three Lines Diſtance from the Cornea, and leaves no Diſorder of this Part unnoticed.

Jefus Hali, a learned Arabick Phyſician, wrote extremely well upon the Diſeaſes of this Organ; tho' the learned Friend, neither fixes
the

PREFACE. xv

the Time of his Writings, nor yet gives any Account of his Works, only just observes;

“ Sunt et alii auctores Ara-
 “ bici, quorum libri extant,
 “ ut Abbenquenfit, Bulca-
 “ sem, Jesus Hali, Cam-
 “ manufali, Rabbi Moses,
 “ &c. quos cum nihil me-
 “ morabile in se habeant, et
 “ id mihi in animo sit, ut
 “ medicinæ potius, quam
 “ medicorum historiam con-
 “ texam, silentio præter-
 “ mitto.” Hist. Med. p.
 257.

*He insisted, that all Cata-
 racts were formed in the an-
 terior Chamber of the Eye;
 that*

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that is to say, between the Cornea-Transparens and Iris; and of Consequence, that the Needle should never perforate the Coats of the Eye posteriorly. But if, says he, in the Operation, the Cataract should slip between the Crystalin and Iris, in this Case, the Needle may pass into the posterior Chamber of the Eye, and so bring it back, and depress it under the Cornea; and in this Case, he affirmed, that the Pupilla was capable of a very great Distention, which would immediately contract itself on the Removat of the Extraneous Body, in the same Manner

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Manner as the Matrix does, immediately after Delivery. And to support this Assertion, he affirmed, that were it between the Iris and Crystalin, it was impossible to remove it, without affecting this Part, and of Consequence, depriving the Patient of Sight. By this it appears, that Aquependente was not the first who affirmed, That it was impossible to introduce the Needle into the posterior Chamber of the Eye, without wounding the Crystalin. This Opinion was also embraced by Albucasis and Mesue; on the contrary, Azaravius, whom Doctor

c Friend

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Friend confounds with Albucasis, was of the contrary Opinion; that is, that there were no Cataracts, but such as were formed between the Crystalin and Iris.

To reconcile those different Opinions, Arculanus, an eminent Physician of Verona in Italy; and who, according to Friend, lived in the fifteenth Century, allows of both Sorts of Cataracts (4). He says, that a Cataract may be formed in the anterior Chamber of the Eye, when the Matter, which

(4) Arculanus in Expos. nonor. libr. Almanzoris.

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which should nourish the Dura-Mater, is not in a good State; or from too great an Abundance of it, or moist Exhalations. In all those Cases the Matter may transude thro' the Sclerotica; and thus, by a Sort of Accumulation, form a Cataract between the Cornea and Iris; and those in the posterior Chamber of the Eye, he thinks proceed from a Defluxion of Matter from the Pia Mater.

Not to mention the numberless Writers on this Part since, as Riverius, Senner-tus, Rolfoncius, Plempius, &c. it has entirely employed

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the Learned, since the Beginning of the present Century. In those Disputes, which are related at large in the Beginning of this Work, the Structure and Mechanism of the Eye, were so accurately handled, on both Sides, that it seemed impossible for any thing new to be said on this Subject. Besides this, not to mention the pretended Discoveries of Nuck, and Ruysch. Hovius, who ascribes the Merit of all those to himself, has writ an entire Book, barely to shew the Circulation of the Humours in the Eye. 'Tis this same, who pretends to shew the
Choroides

PREFACE. xxi

Choroides composed of five Laminæ, or Membranes, and nevertheless declares the Cataract to be a Membrane, formed between the Cryſtalin and Iris!

Petit, formerly a celebrated Phyſician of Namur, and ſince of Paris, has profeſſedly laid himſelf out for Discoveries in the Anatomy of this Part, and not unſucceſſfully. Winſlow alſo has not been wanting for Discoveries in this, as well as in every other Part of the human Body. Morand the Son, has alſo given Obſervations and Remarks on the Eye, and
it's

xxii PREFACE.

it's Disorders, not unworthy of himself. So has the learned Professor Ferren, of Paris, in his Anatomical Lectures. Mr. Cheseldon has been very indefatigable in his Searches too; and proposes a very curious Operation, viz. the making an artificial Pupilla. Mr. Ranby, Serjeant Surgeon to his Majesty, has likewise given some Remarks on the Cataract in the Philosophical Transactions for 1730.

But besides all those, scarce a Winter passes, in which some Theses are not sustained at Paris, Montpelier, or Leyden,

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Leyden, on this Subject: Yet are there some on these Occasions, which should not be forgot; such is the Dissertatio Physico-Medica of Doctor Pemberton, addressed to the learned Doctor Mead; as also the Dissertation of Doctor Camper, in 1744, on the same Subject. Besides an accurate Description of the Eye, and the Uses of it's several Parts, according to the received Opinion; he also gives a Figure of the Canal Godronnée, of Petit; as also a Description of the true Situation of the Eyes in their Orbits, contrary to the Opinion

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nion of a very celebrated Anatomist.

By what has been said, it will appear, how difficult a thing it is to write any thing new on this Subject. Yet I am very confident, that the curious Reader will find several Discoveries well worth his Attention in the following Sheets.

Besides putting an entire End, to the Disputes, about the Seat of a Cataract, which thing alone, has been the Occasion of great Contests in the learned World, the different Opinions, about a Glaucoma,

PREFACE. xxv

coma, and Cataract, are also
 entirely confuted; nor by
 barely saying they were the
 same; but by examining the
 Opinion of each Author on
 this Subject, and at the same
 time shewing, how he was de-
 ceived. Perhaps some may
 think, that I have spent too
 much Time on this Head; but
 I have been the more parti-
 cular in it, first, to avoid the
 Criticisms of People, who,
 though they might be convin-
 ced in their own Mind, yet,
 for the sake of Contradiction,
 or to draw the Attention of
 the People on them, might be
 the Occasion, by taking up the
 Pen, of more unnecessary
 d physical

xxvi PREFACE.

physical Lumber: Secondly, because it is a thing of such necessary Consequence to Mankind in general, and in particular, to the practical Surgeon, to know, that all Opacities are at all times equally curable; seeing that by this, he is not to wait for one particular Time or Season; or till the Fruit is ripe and fit to be plucked off, as St. Yves pedantically expresses it.

As for the small Difference of Refraction, between the Crystallin Lens and Vitreous-humour, I think I have evidently proved it, both from Opticks, Reason, and (which

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is still more convincing) indisputable Facts. I have also pretty manifestly shewn, that there is not any Adherence of the Ligamentum-Ciliare, to the Crystalin-Capsula. Keplerus in his Dioptricks was the first who advanced, that the different Figures the Eye took, were occasioned by the Attaches of the Ligamentum-Ciliare, to the Crystalin. This, tho' it was a curious Remark for a Physician, (I mean a Philosopher) was implicitly submitted to, by all Physicians, and Mathematicians since; nay some (prompted by a laudable Zeal) went further, even to dispute with

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him the Discovery; being
ashamed to say, that so cur-
rious a Remark should be
made by any one, but an Ana-
tomist.

Hovius's Book, I have al-
so examined; not indeed out
of any Desire of being thought
a Critick, but barely to search
out (if possible) the Truth;
seeing that the learned World
are much indebted to him, for
his Discovery of the Blood-
Vessels of the Eye; tho' in-
deed, I believe, if People were
less curious in enquiring into
the first Causes of Things, we
should find Physick at a much
greater Perfection than it now
is;

PREFACE. xxix

is; seeing that some People shall spend whole Months, nay Years too, to find out a Reason, why a Muscle acts, the Heart contracts, or if Sensation be made, by the Animal Spirits; or a vibratory Motion of the Nerves; and yet shall be often at a Loss, to shew or describe a Muscle, a Nerve, &c.

I have also given an Account of this Operation, as it has been practised by the most eminent Surgeons; and have examined into the Merits of each of them, and shewed where they were deficient. I had indeed some Thoughts, to have

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have given an Anatomical Description of the Eye, and afterwards to have examined the different Operations for a Cataract; in Imitation of that celebrated Piece of M. Le Dran's (5); but besides that this would confine me too much, from the general Remarks, which are interspersed thro' this Work, I should be also obliged to repeat several Things, already said over, and over again: 'Tis for those Reasons, that I have published this Piece, as you see it; leaving it to others to make Use of the different Remarks

(5) Parallele des differentes manieres de tirer la pierre, &c.

PREFACE. xxxi

on the real Structure of the several Parts of this Organ, as by repeated Experiments I have found, and here described them. The Method of dissecting an Eye, will, I flatter myself, be not unacceptable to the Curious; seeing that by it every Man may examine the different Parts of this Organ, and see those Discoveries, which, by any other Method, could not be found out.

As for the Cuts annexed to this Work, I took Care to have them finished in the most exact Manner; and in this my Trouble was so much the greater,

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greater, seeing that I was obliged (in order to shew the Parts as they really were) to paint this Part in a Manner quite different from what it had been heretofore represented; and this I thought was the more necessary to be done, seeing that by one Glance of an Eye, a Man can immediately form a just Notion of this Part; as also the more readily comprehend the several Remarks, &c. interspersed thro' this Work. In a Word, Reader, as my sole View has been nothing but Truth, so I have spared no Pains or Labour to come at it. 'Tis upon this Account, that

PREFACE. xxxiii

that I have not once attempted to advance any thing without first manifestly proving it; and if I have sometimes differed from several great Men, it has been only where Facts have obliged me to it. I have endeavoured thro' the Whole, to convey my Thoughts in the most clear and easy Manner, without giving Offence or Scandal to any one, who has differed in Opinion from me.

If then, it will please the curious Lovers of Truth and Certainty, and encourage others to search deeper into those Affairs,

e

xxxiv PREFACE.

*fairs, it will answer the In-
tent, for which I purposed
it.*

*Limerick, the 12th of
April, 1749.*

S. O H.

DISCOVERIES, &c.
A N
A C C O U N T
OF THE
DISCOVERIES, &c.

Made by the AUTHOR, in the
following TREATISE.

1. **T**HE *Cataract* is, ever an Opacity, in the *Crystallin-body* only.
2. The *Glaucoma*, not a different Disease, but a different Name to express this Disorder by.
3. *Phænomena* consequential to this Operation, explained.
4. The Cure of a *Cataract* shewn.
5. The different Motions, in the Globe of the *Eye*, occasioned by the Action of the *Choroides Anterior*.

6. A

DISCOVERIES, &c.

6. A Muscle has different Degrees of Contraction.
7. No Circulation of the Humours in the Eye.

Anatomical Discoveries.

8. The *Iris* composed of Radial Fibres only.
9. The *Vitreous-humour*, not surrounded by any proper Membrane.
10. The *Crystallin-Lens* has no Adherence to the *Ligamentum-Ciliare*.
11. A Substance, partly cartilaginous and boney, in the internal Angle of the Eye, which I have called *Os Optalmicum*.
12. The Origin of the *Aqueous-humour*.
13. Why the Eye is subject to Inflammation, in Consequence of couching.

14. The

DISCOVERIES, &c.

14. The true Situation of the *Cryſtalin-Lens*, and *Choroides Anterior*.
15. A Deſcription of the *Ligamentum-Ciliare*.
16. *Koreotomy* impracticable, as deſcribed.
17. A different Method for performing this Operation propoſed.

E R R A T A.

Page 32. line 3. for Parallel Rays, read
Perpendicular Rays.

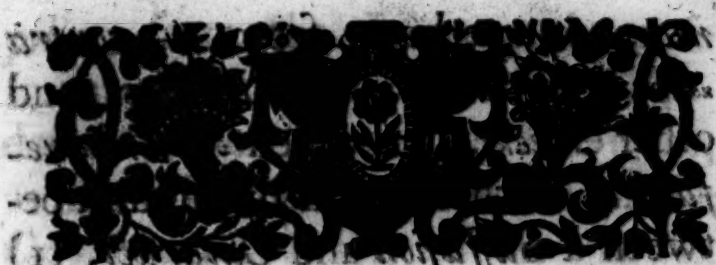
P. 43. l. ult. for Lamina, r. Laminæ.

DISCOVERIES, &c.

14. The true Situation of the Cystic-Less, and Cystoides Anterior.
15. A Description of the Ligamentum Ciliare.
16. Keratomy impracticable, as described.
17. A different Method for performing this Operation proposed.

E R A T A.

P. 13. l. ult. for Laminæ, & Laminæ.
 Perpendicular Rays.
 Page 32. line 3. for Parallel Rays, read



in calling the Suffragan a beginning
Cathedral; and the OF THE
formed Suffragan.

GLAUCOMA.

Q R

CATARACT.

1. **T**HIS Disorder is, by the
Latins, called *Suffusio*;
 but it is more generally
 known by the Name *Cataracta*,
 which, according to *Livy*, signifies
Gates, or any other Obstacle to the
 Entrance of Towns, more especially
 fortified ones: Others will have it
 to be derived from *καταρρέω*, *defluo*, *de-*
labor; others again from *κωα*, *Cor-*
B *nea*;

2 Of the CATARACT.

ned; or, perhaps, from *καταρ* *contra*
id. *id.* *Pupilla*. By *Paulus*, and
 other *Greeks*, it is called *καταρ* *lique-*
facere. Others again distinguish be-
 tween a *Suffusion* and *Cataract*, (1)
 in calling the *Suffusion* a *beginning*
Cataract; and the *Cataract* a *con-*
firmed Suffusion.

H. But, let it's Derivation be
 what it will, all agree, that the *Ca-*
taract is, a *Loss of Sight*, with a
Change of the natural Colour of the
Pupilla, or black, into some other
Colour; as for Instance, to white,
 gray, yellow, &c. By this Defini-
 tion, or rather Description, it is ea-
 sily distinguished from other Disor-
 ders, incident to this Organ. It is
 known from the *Amaurosis*, because
 in it, the Sight is lost, without any
 Alteration in the Colour of the *Pu-*
pilla;

(1) *Praxeos Mayeri in morbo intern. c. xiii.*

Of the CATARACT. B

pilla; from the *Leucoma*, because in this, 'tis the *Cornea* that is rendered *opacous*. From the *Pterygion*, as it is a Membrane, that covers the *Cornea* *transparens*. It is known, from the *Hypopyon*, as this last is purulent Matter, collected between the *Cornea* and *Iris*, and fluctuating; when, on the Contrary, the Opacity in the *Cataract*, seems solid, and behind the *Pupilla*. And here I should with a great deal of Perspicuity, endeavour, according to Custom, to distinguish between this Disorder and the *Glaucoma*; but as I see very little Reason; (or rather none at all, as I shall shew presently) for such Distinction, I shall, with the Antients, esteem *Glaucoma* et *cataracta* eundemque morbum esse, as *Oribasius*, *Synops. Med. lib. viii.* remarks of them.

4 Of the CATARACT.

III. But tho' the Fathers of Physick, had called all Blindness with a Change in the Colour of the *Rapilla*, indifferently, *Cataracts*, or *Glaucoma's*; yet Experience satisfi'd their Successors, that there was a great and essential Difference between them; the one being a Disorder, which admitted of a Cure, by the Operation; and in the other, the Operation serv'd only to remove the Deformity in the Eye, without adding anything to the Sight, which *Oribasius* also remarks, by saying, *Glaucomata omnia, curationem non recipiunt, &c.* And as those Opacities which they found irremediable, seem'd mostly of a grayish blue, or Sea Colour; they only were call'd *Glaucomata à nomine Canus, vel, quasi glauci coloris*; and the curable ones, *Cataracts*.

IV. They

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5

IV. They therefore then unanimously agreed, that the Cataract was an Opacity, occasioned by some Pellicle or Membrane, formed in the posterior Chamber of the Aqueous humour, which they supposed to be much more capacious than the anterior; and the Glaucoma the Crystallin Lens affected; for as this Body was looked upon, as the most essential to Vision, they concluded, that it only was affected in the Glaucoma; and, of Consequence, Sight inevitably lost.

V. The first who attempted, with Success, to shew the true Seat of a Cataract, were, Messieurs Brisseau, Antoine Maitre-Jean, and Heister: The first in his *Traité de la Cataracte & du Glaucome*, Paris 1709: The next in his *Traité des Maladies de l'œil*, Troyes 1707; and the last in his *Tractatio de Cataractâ & Glaucomate*,

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Glaucomate, Altorfii, 1713. Nor should we, on this Occasion, forget *Petit* the Physician, who has proved from Experience, (*Le Traité de Brisseau, p. 161*) and the Structure of those Parts, (the posterior Chamber of the Eye, being but $\frac{1}{4}$ of a Line) the Impossibility of the Existence of a membranous Cataract there. *Voyez sa lettre, où il démontre, que le Crystallin est fort près de l'Iris.*

VI. The first Observation was made by *Brisseau*, in 1705, on a Soldier, who laboured under a perfect Cataract. This Man, happening to die of a Flux, *Brisseau* depressed the Cataract, on the Body, with the same Precautions, as if on a living Subject, till such times as he saw the Opacity removed from behind the *Pupilla*. He then takes out the Eye from it's Orbit, in order to examine the Body he had depressed. He

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He therefore opens the *Cornea*, and after the *Aqueous-humour's* having discharged itself, he found, instead of a *Membrane*, the *Crystalin-Lens* itself *opacous*, and depressed under the *Vitreous-humour*. To be more certain, he opens the other *Eye*, and found the *Crystalin-Lens* transparent, and in it's natural Place.

VII. This remarkable Observation confirmed by very strong Arguments, was read before the *Royal Academy* the Eighteenth of *November*, of the same Year. But the *Academicians* seemed to make slight of this Discovery; nor did they think proper, to give it a Place in their Works. However this cool Reception did not deter *Brissseau* from maintaining his new Opinion, viz. That it was the *Crystalin-Lens*, which was constantly obscured in the *Cataract*; and therefore,

VIII. In

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VIII. In 1708, he published four Cases more, to confirm his new Doctrine; in each of which he constantly found the Opacity, to be in the *Crystalin* Body itself, as in his first Experiment; and differing in nothing from it, except in the Degrees of Colour and Consistence in this Body; as being sometimes harder, sometimes whiter, or yellower; but *never* a *Pellicle* formed in the *Aqueous-humour*, as was before imagined.

IX. In 1709, he collected all those Pieces which he had separately published on this Affair; added to them several new Observations, both of his own and others; and, in a Word, seemed to make the true Seat of a *Cataract* indisputable. But as this was a great Innovation, with respect to the then received Opinion, of the Uses assigned to the
Crystalin-

Of the CATARACT. 9

Crystallin-Lens; it did not fail of raising him a great many Enemies, both Physicians and Mathematicians; amongst whom, *de la Hire* the Father, *Litre* and *Mery*; (2) and the noted *English* Oculist, *Woolhouse*, (3) were his greatest Opponents.

X. Nor was *Maitre-Jean* wanting to confirm this new Doctrine by Facts. In Pag. 115, &c. you have two Histories: The first, of a Person who died, labouring under a perfect *Cataract*; and on whom the Operation was not made. In examining this *Eye*, he found the *Crystallin-Lens* in it's natural Place, but *opaque*; and as if infused in some *acid* Liquor. The other was of a Woman, on whom the Operation had been successfully performed,

(2) *Memoires de l'Academie*, 1706, 7, 8.

(3) *Dissertations sçavantes & critiques, &c. Memoires des Trevoux, &c.*

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ed, for *both Eyes*. This Woman, dying some Time after, he examin-
ed *both Eyes*; and found in each,
the *Crystallin-Lens* opaque, and ly-
ing under the *Vitreous-humour*; and
this last Convex in it's anterior Part,
and occupying the Place of the de-
pressed *Crystalin*.

XI. However, it is to be noti-
ced, that tho' *Brisseau* and *Maire-
Jean*, were the first, who evidently
demonstrated the *Cataract*, to be
an Opacity of the *Crystallin-Lens*;
yet they were not the first, who
made that Observation. For *M.
Lafmier*, an eminent Surgeon of
Paris; and who died in 1696,
made the same Remarks, forty Years
before. And tho' he was counte-
nanced in this Opinion, by *Robault*,
(4) and *Gassendus* (5); and that
in

(4) *Robaultus* in tractatu suo physico, Pars I.
cap. xxxv.

(5) *Gassendi opera*, Tom II, p. 371.

Of the CATARACT. II

in a little *Analysis* of Mariotte's, *Nouvelles Decouvertes, touchant la Vue*, it was publickly asserted, "That Oculists had found, that there was no other Way, of curing that Disorder of the Eye, called a Cataract, but by depressing the Crystalin," &c. (6) Yet it was not sufficient, to gain it any Esteem, in the World. II

XII. But, because I see, not only *Litre* and *Woolbouse*, to argue for *Membranous Cataracts*; but also *Heister*, who wrote with so much Spirit and Learning against this Doctrine, in his *System of Chirurgery*, own, that there are *Membranous* as well as *Crystalin-Cataracts*. I observe, that there are none, but *Crystalin-Cataracts*; because of the small Space of the *posterior Chamber* of the Eye, (N. V.) which in all

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Situ-

(6) *Journal des sçavans*, 1668.

12 Of the CATARACT.

Situations and Positions of the Eye, is constantly the same; as may be more fully seen, by Mr. Winslow's *Membræ*, in *The Works of the Academy for 1721*; or by considering the real Situation of the *Crystallin-Lens* and *Iris*; which are truly represented in the Plates, annexed to this Work. See *Plate I. Fig. I. and II.*

XIII. But because I see *St. Yves* (7) goes farther, in pretending to give Signs to distinguish, between a *Membranous* and a *Crystallin-Cataract*; by observing that in the former, it will appear flat, and hollow in it's Center, by looking thro' the *Pupilla*; when, on the Contrary, in the *Crystallin-Cataract*, the Opacity seems more elevated in it's Center. But this, I answer, is no true Sign, to know them by, were there

(7) Les maladies des yeux, chap. xviii.

Of the CATARACT. 13

there any such *Cataracts*; because, amongst the Number of *Eyes*, which I have dissected, I have met with two that were *cataractous*, each of which seemed to answer to St. *Kes*'s Description of a *Membranous Cataract*; being quite flat in the Middle. But upon examining them, I could easily perceive the *Crystallin Capsula*, tho' dented in, for Want of a sufficient Convexity in this Body; and the *Crystallin* partly dissolved. But: what principally formed the Opacity, was, that it was divided into three Parts, each from the Center; (just as this Body will do, when laid in Water, for a Couple of Days; and which was *Hovius*'s Method of examining it) (8) with the more fluid or dissolved Parts interposed; tho' each of those Parts, when separately examined, seemed transparent.

(8) Consule *Hovii* opera, tab. iv. fig. iii. fig. iv. in tab. v.

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transparent. Since I had first the Opportunity of making those Remarks, I have met with several Eyes, which answered to the same Description; and I find, that this is, the Sort of *Cataract* that generally attacks old People.

XIV. However, tho' most People are now well satisfied, that, the *Cataract* is a Disorder of the *Crystallin*; and that this Disorder is remediable by the *Operation*: Yet they are far from agreeing, to the Seat of a *Glaucoma*. All conclude, that it is a Disorder that widely differs from a *Cataract*; because this is remediable by an *Operation*; when, on the Contrary, in the *Glaucoma*, the *Operation* is of no further Service, than to take off the *Blemish* in the *Eye*, without in the least contributing to the restoring of Sight. For as it had been a received Opinion, that the *Cataract* was a *Pellicle*

Of the CATARACT. 15

licle formed by the *Aqueous-humour*, in the same Manner as is remarked of Wine or Vinegar, tending to Putrefaction, which forms a Skin on it's Top; so by depressing this Membrane, Sight was restored. But the *Glaucoma*, as an incurable Disorder, they placed in the *Crystallin-Lens*. But, as later Experiences have proved, the *Cataract* to be a Disorder of the *Crystallin*, they have still thought fit to keep up the Distinction; each describing the *Glaucoma*, as Caprice or Fancy led him to think of any other Disorder, which, joined to a *Cataract*, might still keep the Person blind; tho' no Matter whether such a complicated Disease existed in Nature.

XV. Tho' all agree to the Existence of a *Glaucoma*, or incurable *Cataract*, yet they are far from agreeing to it's Seat, or the pathognomonic Signs of it. It is by all Sides

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Sides affirmed, to be a Disorder that seldom happens, which *Widelius* (in *Dissertatione de Cataractâ*) notes, in saying, *Quinquaginta senes, Cataractâ laborantes videbis, quàm unum, Glaucomate strictè sumpto.*

XVI. *Maitre-Jean* (9) says, that a *Glaucoma* differs in this from a *Cataract*, that, besides the Opacity of the *Crystalin-Lens*, there is also a Hardness and Driness of this Body; and this Hardness, and Opacity, or, with him, complicated *Cataract*, is a *Glaucoma*, or, incurable Disease. But, as it is evident, that what *Maitre-Jean* calls a *Glaucoma*, is remediable by the Operation, therefore his Difference is not good, since he agrees with the rest, that the *Glaucoma* is incurable. 'Tis for the same Reason, that we reject *Woolhouse* and *Mery's* Opinion.

XVII.
(9) *Les maladies de l'oeil*, p. 204, &c.

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XVII. *Brisseau* (1) says, that this Disorder is an Opacity of the *Kitreous-humour*, joined to a *Cataract*; so that in this Case, altho' you depress the *Crysalin*, yet the opaque *Kitreous-Tunick* still hinders a Passage to the Rays of Light. To illustrate which, you have the History of *M. Bourdelote*, the King's Physician, who had for some Years laboured under a perfect *Cataract*, in one of his Eyes. At his Death, he ordered, that the diseased Eye should be examined, in order to clear up the Disputes about the true Seat of a *Cataract*. This was done by *Mareschal*, the King's first Surgeon; who found the *Crysalin-Lens* opaque and solid, with it's *Nucleus*, or *Center*, of a more solid Consistence, and yellower Colour than it's Circumference: The Si-

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nus,

(1) *Traité de la Cataracte, & du Glaucomé.*

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mus, or Cavity, of the *Vitreous-humour*, in which this Body was lodged, was eluded almost a Line in Depth; and this he concludes to be a *Glaucoma*; because, says he, tho' the *Cataract* were depressed, yet the Opacity of the *Vitreous-Membrane* would still stop up the Passage of the Light. Therefore this agrees with the Observations of most Authors, in it's being, an *incurable Disorder*.

XVIII. The learned *Heister* (2) is very zealous to preserve a Distinction between those two Names. He observes, that the *Glaucoma* is an Opacity of the *Vitreous-Tunick*, and concludes, that the above Case, mentioned by *Brisseau*, to be that of a true *Glaucoma*. Hence he concludes, that an Opacity of the *Cristallin-Lens*, as a *curable Disorder*,
answers

(2) Tractat. de Cataracta & Glaucoma. (1)

Of the CATARACT. 19

answers best to the Name of a *Cataract*; but most improperly to that of a *Glaucoma*. And the Author has, and

according to his wonted Manner,

XIX. St. *Yves* (3) imagines to

have discovered the true Difference

between those Disorders. He denies

against *Mery* and *Woolhouse*, the

Seat of a *Glaucoma* to be in the

Crystallin-Lens; nor does he better

agree with *Heister* and *Brissau*, in

assigning it to the *Vitreous-humour*.

He affirms, "that by a close In-

spection into *Eyes* affected with

"this Disorder, he found a kind of

"Change in the *Crystallin-Lens*,

"which came upon a *Palsy* of the

"*Ciliary-Nerves*." Or a *Glau-*

coma is a *Cataract* joined to a *Gutta*

Serena.

XX. *Taylor* (4) defines the *Glau-*

coma to be a Disorder, wherein, not

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only the *Crystallin-body* is affected, but its *Capsula* also. Its Colour, of a *Sky-blue*, and the *Pupilla immobile*; and according to his wonted Manner, makes three different Species of it; none of which, I dare be bold to affirm, ever came under his Cognisance. In the second, he says, there is, not only an Opacity of the *Crystallin-Lens*, and its *Membrane*, but that this Body is also augmented, so as to push the *Iris* forwards. In the third Sort, this Body is so much increased in Quantity, as to fill the two Chambers of the *Eye*.

XXI. Now the Disputes, which have so long existed, with respect to the *Cataract*, were not occasioned about the true *pathognomonic* Signs of this Disorder; because, all have agreed, that it is some *opaque* Body, which, lying behind the *Pupilla*, obstructed the Passage of the Light.

— Their Disputes then, were only about

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about the Parts which were rendered *opaque*; which, tho' they helped in a great Measure, to the more fully clearing up of this Disorder; yet changed nothing, with respect to the Operation. But, with regard to the *Glaucoma*, it is quite otherwise; which all will have to be a Disorder very different from a *Cataract*; tho' we have no certain Signs to distinguish them from each other; nor any certain Reason for such Distinction. *XXII.* *Heister* and *Brisseau* imagine this Disorder, to be the *Vitreous Humour* affected, as was the Case of *M. Bourdelote*; but if I shall shew you, that those Appearances in his Eye, were occasioned by Inattention to the Structure of this Part only; you will then, I hope, conclude with me, that they knew not the Difference between those Disorders.

XXIII. But

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about the Parts which were rendered
 white. But, because I see the
 learned Historians give particular Signs
 (which indeed are in themselves, rather
 what Riders and Senners gave
 before him) to distinguish between
 those Disorders; I think I cannot
 pass by, without taking Notice of
 them. The Claudomas says he, this
 ing and Opacity of the *Vitreous*
Membrane, it appears through the Crys-
talin, as if a Body, like Adamant,
 or clear Glass, were lodged there;
 and by pressing to the further Back,
 behind the *Pupilla*, that the *Conjunctiva*
 is common by itself. *Traité de Cat-*
aractes fol. 6. *de Cat. M.* In folio
 260. He gives two Histories of this
 Purpose. The first, of a Man blind
 of both Eyes, who *Hindani*, an ex-
 cellent Surgeon of *Amsterdam*, had
 derooked that, says he, was
 could plainly see the Needle move,
 behind the *Pupilla*; yet this blinding
 Opacity was far beyond the Needle,
 and

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and could not be removed, or suppressed; and therefore the Operation did not succeed. Another such like Operation, performed by Borsetius, was equally unsuccessful, on the same Account.

XXIV. Now it is evident, that there must have been, an Opacity of the Crystallin-Lens in the above Cases; or, for what Purposes would they have passed the Needle? And if so, how could the Opacity of the Vitreous-humour shew itself thro' this Body, when it refused Admittance to the Rays of Light from external Objects? If it were the Vitreous-humour only which was affected, as he seems to think, it should rather (in order to render it opaque) exhibit some other Colour, thro' the Pupilla, than a transparent, or clear Glass-colour, which every body knows to be the true Colour of this Humour, in a sound State

of

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of the *Eye*; and yet I am sure, no body will pretend to guess, at it's Colour, by looking thro' the *Pupilla*: With how much less Reason, then, should we judge of it's Alteration in a morbid State?

XXV. But, because the learned Author observes, that the *Cataractæ splendentes, & lucentes*, may be always ranked amongst the *Glaucomata*, or incurable *Cataracts*: I remark, that not only *Paré* and *Antoine*, &c. give Instances. of the Cure of such *Cataracts*; but also, that *St. Yves* (5) expressly says, that “the
“ Sky-coloured; those of a shining
“ Silver, somewhat like clear Glass;
“ and those of the Colour of Sea-
“ water, succeed best, next after
“ the Pearl-colour.”

XXVI. As to *Taylor's* Distinction, I only observe, that *Petit* the Physician

(5) Les maladies de yeux, chap. xviii.

Of the CATARACT. 25

Physician denies any Connexion, or Communication, between the *Crystallin-Lens* and it's Covering; and that in all States of a *Cataract* he has constantly found this last transparent. *Memoires de l'Academie des Sciences*, 1730. He also affirms, that in every State of a *Cataract*, whether hard or soft, of a long Standing or short Duration, he has constantly found the *Crystallin-Lens* smaller, than in it's natural State. (*De cette contenant des reflexions, sur ce qui M. Hequet a dit, touchant les maladies des yeux, p. 16.*) And I dare be bold to affirm, that all who are acquainted with the Writings of that great Man, will take his Word for it.

XXVII. But *St. Yves's* Opinion, is certainly the most ingenious: He defines a *Glaucoma* to be a *Cataract*, complicated with a *Gutta Serena*; and in this Case, it is manifest, that

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depressing the *opaque Crystalin*, can no way contribute to the restoring of Sight; because the *Amaurosis* alone is *perpetual Blindness*. But if you mind his Words, you will find, that he had no more Experience for what he advanced, than the Gentlemen his Predecessors. He remarks, “that by a careful Inspection into *Eyes* attacked with “this *Diforder*, he found a sort of “Alteration in the *Crystalin*, which “supervened to a *Palsy* of the *Ciliary Nerves*.” Now it is evident, by his own Words, that those Observations were made, on People already attacked with a *Cataract*; and in this Case, how could he observe this previous Weakness in the *Muscle* of the *Iris*? And as to the Dilatation of the *Pupilla*, we all know, that the weaker the Impression, which the Rays of Light give to the *Choroides*, the greater is the Relaxation

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Relaxation of this Part. See N. LXVII.

COROLLARIUM I. From what has been said then, it is evident, that the Disputes about the certain Seat of a *Cataract*, are entirely removed: Disputes which have too long employed the learned World; seeing that if they had but considered, the true Situation of the *Crystalin-Lens* and *Iris*, a very great deal of Time, Labour, and Paper, might have been saved; but yet somewhat of greater Consequence, than all this, particularly advantageous to Practice, may be drawn from the Above.

COROLLAR. II. As then, all *Cataracts* are *Opacities* of the *Crystalin-Lens*; that the *Glaucoma* is but a different Name, for the same Disorder; and that all *Suffusions* of the *Crystalin-Lens* are remediable, it necessarily follows, that all *Cata-*

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racts are equally so. And we do affirm, that all *Opacities* of the *Cryſtalin-Lens*, whether *hard*, *ſoft*, or in whatſoever other State, are equally curable, by an *Operation* which we ſhall preſently ſhew; *provided* they be not complicated with a *Gutta Serena*; which no Author, but *St. Yves* takes Notice of; and indeed, he ſhould firſt have produced ſome *Inſtances*, to ſupport that Opinion, in order to gain it Credit: But I could produce an *Inſtance* in this Town, of a Woman who had a *cataractous Eye*, in which the *Iris* had very little perceptible Motion; and which *Taylor* had declared *incurable*; which I nevertheleſs reſtored her the Uſe of the Twentieth of *March*, 1749; but that I think, what has been ſaid, is ſufficient to ſatisfy any Man, who ſeeks after the Truth.

COROLLAR.

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COROLLAR. III. From the foregoing also, the true State and Consistence of a *Cataract* may be found: Thus, for Instance, if it be more elevated in it's *Center*, than in it's *Circumference*, we may affirm the *Crystalin* to be hard: If flat, or depressed in it's *Nucleus*, we may conclude a *Solution of Continuity* in the Parts of it: If it seems more prominent, or jetting out in the inferior, than the superior Part of the *Pupilla*, we may say, it is a *soft*, or *milky Cataract*.

XXVIII. Now in the Case of a *Glaucoma*, *Cataract*, or *Opacity* of the *Crystalin-Lens*, the Intentions of the Operation, are, the *depressing* of this *opaque Body*, by Means of which, the Rays of Light will have a free Ingress to the Bottom of the *Eye*, and Sight be restored. But as the greatest Success we can promise ourselves,

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ourselves, from the *Needle*, is, to give the Patient some feint Notion of Colours, and Light sufficient to direct him ; and even this is so uncertain, that sometimes it shall be but instantaneous ; sometimes shall continue for a Month or two, or longer ; and but very few Instances, where it has remained, with even this small Degree of Strength, for any considerable Time. From thence, the great Uncertainty of Success, in this *Operation*, even in the most promising Cases (the Truth of which the best Authors acknowledge) it may be debated, whether it had not been better, to be entirely laid aside ? And indeed it seems to be so, by the most eminent *Surgeons* ; who do not care to hazard their Characters, on an *Operation*, from the Success of which only, People judge of the Abilities of the Performer. Tho' indeed it has this to recommend it, (as the learned *Heister*

Of the CATARACT. 31

ster justly remarks) that to a Person well-instructed in the Knowledge of those Parts, there is not the least Danger to be apprehended.

XXIX. This small Degree of Light, which the Patient has, after the Operation is well-performed, has very much puzzled *Physicians* and *Mathematicians*, to account for: However, they have done it thus; ——— It is a Principle of DIOPTRICKS, That, *Rays of Light, passing from a rarer, into a more dense Medium, are refracted, acceding to the Perpendicular.* Now the Rays of Light, passing thro' the Air, from a *luminous Body*, to the *Humours* of the EYE, which are a *denser Medium*, are here refracted, or broke in their Direction; and this Power of *converging the Rays of Light*, is still greater, in Proportion to the Density of the Body thro' which they pass. However, it is to be

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be noticed, that this Law only regards those Rays, which fall in an oblique Direction; because *parallel* Rays, passing thro' different *Mediums*, suffer no Refraction; seeing there is no Obstacle in the Body, thro' which they pass, that should incline them, either to the Right, or the Left; therefore they keep their pristine Direction.

XXX. Now, this being the Case, if the Eye was filled with the *Aqueous-humour* only, the Rays of *Light* would be converged to a Point considerably beyond the *Retina* (6). It was therefore necessary, that some other Body, of greater Density than the former, should be interposed, in order to unite those Rays, in a Point nearer the *Retina*. To which Purpose, the *Crystallin-Lens* wonderfully answers;

(6) *Martin's Opticks*, *Smith's Principles of Opticks*, and *Dr. Jurin's Letter*, &c.

Of the CATARACT. 33

answers; which, by it's *Convex*-figure, serves to unite the Rays sooner; and therefore, passing thro' the *Vitreous-humour*, which is of less Density than the former, and of a *Concave*-surface, the Rays must be still more *converged*, so as to unite upon the *Retina*.

XXXI. If then, by any particular *Idiosyncrasy*, the *Crystalin* be rendered *opaque*; when displaced by the *Needle*, the *Vitreous-humour* fills up it's Place; and necessarily forms a *Convexity* in it's anterior Part, by the lateral Pressure of the suppressed *Crystalin*. But as this is a rarer *Medium*, than the *Crystalin*, of Consequence, the Rays of *Light* are not so strongly *converged*; their *Focus* is therefore beyond the *Retina*, and *Sight* should be *confused*.

XXXII. But, because a great many object, against the antient Doctrin,

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trine, That, if the Cataract was a Membrane formed in the Aqueous-humour; after depressing this Membrane, the Patient should see, as well as ever; seeing, that there was no other Obstacle to their recovering Sight. But it is evident, that they, who make those (as they call them) unanswerable Objections, are not acquainted with the antient Doctrine: For the Antients taught, that as the Cataract was formed by the more dense or solid Parts of the Aqueous-humour, accumulated; yet tho' this Membrane, or, accumulated Matter, were suppressed, Sight was still imperfect; because the Remainder of the Aqueous-humour, had lost it's more dense Parts; the Refraction, therefore of the Rays of Light, was not so great, and Sight was proportionably weak. This I mention, not that it is any way necessary to our Discourse, but barely to shew, how justly the Antients reasoned;

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reasoned; and at the same time, that the Sentiments of all Parties, with respect to this Disorder, might be here explained.

XXXIII. But it is to be remarked, that the most exact Opticians, have found this Difference of Refraction, between the Crystallin-Lens and Vitreous-humour, so inconceivably small, that it is scarce discernible (7). Their Difference, as to Density and Specifick-gravity, is but small. If then, the Refraction of the Rays of Light, out of Air into Diamond, (the most dense Medium) is, according to the nicest Observations, but as five to two; how very small then must it not be, when passing from the Crystallin-Lens to the Vitreous-humour? so small, that the learned Heister (in Dissertatione de

F 2 Amaurosi)

(7) Kepleri Dioptrices, Newton, de la Hire, &c.

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Amaurosi) thinks, that the Resolution of the Vitreous-humour into Water ; (8) and even that of the *Crystallin-Lens* too (9) ; are not alone, by their *Rarity*, sufficient to cause a *Gutta Serena*. But can any thing more manifestly shew, the very small Difference of *Refraction*, between those two Bodies, than the simple Experiment of HUGENIUS, *Dioptr. Propos. 31* ? Who, by forming an artificial Eye, with the same Size of a natural one ; and filling it, with Water only, had the Images, from external Objects painted on it's Bottom. See further Improvements on this Machine, in Heister de Cataractâ, Fol. 137, &c.

XXXIV. But those our Arguments are unanswerable, if we reflect

(8) L'Anatomie Chirurgicale de Palfin, p. 396.

(9) Rolfe's Dissertat. Anatom. lib. I. cap. xiii.

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fect on the noted Instance of *Surgeon Petit*, the Father ; (1) who tells of a Man, in whom the *opacous Crystalin* had passed into the anterior Chamber of the *Eye*, which Body he extracted, by opening the *Cornea* ; and nevertheless, this Man could see with the same Force, that People generally do, after depressing the *Cataract*. *St. Yves* (2) relates two or three more such Histories, in his own Practice. Now, if the above *Hypothesis* (N. XXIX.) were true, this Man should not see at all ; because, besides the *Vitreous-humour's* being a *rarer Medium*, (N. XXX.) the *Crystalin-Lens* is also taken out, and the *Eye* has not it's full *Convexity*. And in this Case, the Rays of Light should unite at a Point, considerably beyond the *Retina* : The *Falsity* of which,

(1) *Memoires de l'Academie Royale des Sciences*, 1708.

(2) *Les maladies de yeux*, chap. xxi.

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which, those Instances manifestly prove.

XXXV. But, because the ingenious Dr. *Porterfield* (3) shews the Impossibility of a Man's seeing well, after depressing a *Cataract*, from the Difference of Texture, in the Body of the *Crystallin*; it being more solid in it's *Center*, than in it's *Circumference*; and of Consequence, that the Light should here suffer a greater Degree of *Refraction*. This *Mechanism* the *Doctor* thinks was necessary; because, otherwise, the Rays, passing thro' it's *Circumference*, would meet at a Point nearer the *Retina*, than those which passed thro' it's *Center*; the Light in this last Case, running a smaller Space. This Objection had been made to me, before I saw the *Doctor's* Second *Essay*, by Dr. *Camper*, a very ingenious

(3) Medical Essays of *Edinburgh*, Vol. IV.
p. 152, &c.

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nuous Physician of *Leyden*, and who has particularly applied himself to the Study of this Organ.

XXXVI. But to this, I answer, that if we consider, *that the Center of the Cryſtalin, is always parallel to that of the Pupilla*; we will find, that the Rays of Light, which fall on this Part, ſuffer no *Refraction*. (N. XXIX.)— From all which, I think, we may juſtly conclude, *Fiſt,*

That the Reason, why we ſhould not ſee better after the Operation, (not to mention, the Uncertainty of it's ſucceeding in moſt Caſes) has not yet been ſufficiently known. Secondly,

That the Cryſtalin-Lens no further contributes to Sight, but by it's Transparency, and ſerving as a Medium, to preſerve the due Convexity of the Eye.

XXXVII. But

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XXXVII. But those Corrollaries, will still appear more manifest, if we consider, what numberless Experiments have satisfied me of: viz. That the Crystallin-Lens, in most Sorts of Animals, (Men, &c.) of the same Species and Age, is generally of the same Weight, Convexity and Diameter: Thus, for Instance, in Men, it is about four Grains; in Youth, two Grains, $\frac{1}{4}$, or three Grains: In Sheep, about twenty Grains, in Bullocks, forty, and so on. But the Vitreous-humour, never preserves this Regularity; for, in the two Eyes taken out of the same Head, you will find a great Difference, with respect to their Quantities; one Eye containing, sometimes a Third more than the other, sometimes less; but rarely, the two Vitreous-humours of the same Animal are, alike heavy.

XXXVIII. *Lemnius* (4), as also *Borelli*, have observed, that we see better with the *left Eye*, than with the *right*; and indeed, in general, this Observation is true: But *M. Le Cat* (5) denies it to be constantly so; because, sometimes (as he says in his own Case) the right is the best sighted. This *Phænomenon* some have accounted for (6), from the different Partings of the two *Carotid-Arteries*: The left, arising immediately from the *Aorta*; whilst the right Parts, from the right *Subclavian*; and of Consequence, the left Eye is better and sooner supplied. But this cannot be a satisfactory Reason, even tho' the left *Eye* were always the best sighted. This Disproportion then, in the *Vitreous-humour*,

(4) De miraculis occultis naturæ, p. 371.

(5) Traité des sens.

(6) Les Entretiens physiques de Pere Regnault.

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mour, evidently points out the Reason of this Appearance.

XXXIX. This Disproportion of the *Vitreous-humour*, very naturally explains, the Cause of the *Præbitæ*, or long-sighted; and the *Myopes*, or near-sighted. Those are generally imagined, to proceed from the too great Convexity of the *Crystalin-Lens*, in the latter Case; by which Means, the Rays of Light, from distant Objects, unite, before they arrive at the *Retina*; or, from too great a Flatness of this Body, in the *Præbitæ*, on which Account, the Rays from near Objects, have their *Focus*, beyond the *Retina*. But as those different Figures of the *Crystalin*, are only imaginary; and that, the too great, or too small Quantity of the *Vitreous-humour*, in different Eyes of the same Species (N. XXXVII.) is manifest, we think this last more evidently

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evidently to account for those *Phænomena*.

XL. Having then, I think, evidently proved, the very small Difference of *Refraction*, between the *Crystallin-Lens*, and *Vitreous-humour*; too small, to occasion that very small Quantity of Light, which People enjoy, after precipitating the *Crystallin*: I shall now shew, by the same Force of Arguments, and Facts equally *convincing*, the *true Reason*, why we do not possess better Sight, after depressing the *Cataract*; as also propose an Operation, by which a Person, in any State of a *Cataract*, SHALL SEE, PRETTY NIGH AS WELL AFTER THE OPERATION, AS IF NO SUCH DISORDER HAD EVER HAPPENED.

XLI. The *Vitreous-humour* is covered, by a very fine *Membrane*, which is composed of two *Lamina*:

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At the Cavity or Socket of the *Vitreous-humour*, in which the *Crystallin-Lens* is lodged, those *Lamina* separate; the internal Covering, the Cavity of the *Vitreous-humour*, and posterior Convexity of the *Crystallin-Lens*; whilst the external *Lamen*, surrounds the anterior Part of this Body; by which Mechanism, the *Crystallin* is firmly attached to the *Vitreous-humour*. It is remarkable, that the anterior Part of this Membrane, is much thicker than it's posterior Part; and this M. *Winslow* seems to think (7), proceeds from some Expansions of the *Retina*, over this Membrane. *Morgagni* has observed, that the internal Surface of this Membrane, is constantly humected with a clear *Lymphatick-Water*; and *Petit* the Physician (8) denies any Communi-
cation

(7) Exposition Anatomique, Tom. IV.

(8) Memoires de l'Academie, 1730.

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cation between this Membrane, and it's interposed Body, either by Blood-Vessels, or otherwise ; but that this last is nourished, by absorbing the Lymph surrounding it.

XLII. This Lymph is supplied by a particular Vessel, which piercing the *Eye*, with the *Optick-Nerve*, passes obliquely thro' the *Vitreous-humour*, and surrounds the posterior Part of the *Crystalin-Lens* ; giving very fine Ramifications, which creep into this Body, and discharge themselves there. *Petit* the Physician, has constantly found this Lymph to exist, as well in a morbid, as a sound State of this Organ.—We have often Instances of *Cataracts* subsiding of themselves ; of this *Mayern* (9), and *ô Mara* (1) give two notable Histories : This happens, when the *Crystalin* has acquired a solid Consistence ;

(9) Prax. Mayern. cap. xiii.

(1) Historiæ aliquot medicæ rariores, p. 174.

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sistence ; and by continually pressing upon the inferior, and lateral Part of the *Capsula* ; which is least capable of Resistance, it at length, gives Way, and the *Crystallin* slips thro' the Opening by this Liquor's lubricating the internal Surface of the *Capsula*.

XLIII. The Structure of this Membrane, being thus described. The Needle being introduced, and the *Capsula* perforated, the *Crystallin*, by a certain *Encheiresis*, is thrown out, and depressed, under the *Vitreous-humour* ; but it's Membrane, or Covering, still remains, being a Continuation of the *Vitreous-tunick*. Now this *Capsula*, being a Part endued with a great Elasticity, immediately after retracts itself, and covers the now convex *Vitreous-humour*.

XLIII. If

XLIII. If then it happens to be still transparent, the Light may pass thro' it, (shrivelled as it is) for some time ; but as those very fine *Capillaries*, which part from the *Vascular Circle* of the *Iris*, to ramify upon, and nourish this Membrane, are, by this Means broke, it is rendered opacous, and of Consequence, light, very much obstructed. And it is this Membrane, thus pierced, which *Maitre-Jean* calls by the Name of an *Appendix*, or Excrecence of a *Cataract*. It was this also which occasioned those ragged Films, which our learned Countryman, the Honourable Mr. *Boyle* (2) observed in a Man after couching a *Cataract*. But then it may be demanded, why those Filaments are not oftener observed ? To which, I answer, that it depends, *first*, on the Skill of the Operator, in not hacking

(2) Philosophical Works, Vol. III. p. 595.

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hacking this Membrane too much: *Secondly*, on the Quantity of the opaque Body depressed. For if it be not much diminished in Bulk, the Eye loses nothing of it's Convexity; and of Consequence, this Membrane has not sufficient Space, to float in the Eye.

XLIV. Now in examining an Eye, upon opening the *Cornea trans- parens*, and pressing on the Ball of the Eye, the *Tunica-Aranæa* is broke, and the *Crystallin* immediately disengages itself and pushes it- self thro' the *Aperture* in the *Cornea*. By this Means, it's Membrane lies on the Socket of the *Vitreous-humour*, unregarded by reason of it's great Transparency; tho' most who have dissected an Eye this Way, have found somewhat like Hairs in the *Vitreous Cavity*, which were nothing else than the Folds of this Membrane. Perhaps, it might be some such

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such Appearance, which occasioned the learned *Brigs* (3), and some other great Men, to deny the Existence of any such Membrane: But it certainly, not only exists, but is also of much greater Density, than is generally imagined; seeing *M. Winslow* (4) has been able, with a common Scalpel, to shew it composed of two *Lamina*, with a Sort of Cellulare Substance interposed.

XLV. But if you infuse an Eye, for thirty or forty Hours, in Spirits of Wine, or any other *Acid-Menstruum*, and after examine it, as above, you will find a whitish Sort of Opacity, in the *Vitreous-Cavity*; which is occasioned by this Liquor's rendering, the Humours of the Eye more solid, and opacous, and their Membranes denser. Now in examining

(3) *Ophthalmographia*, pag. 16.

(4) *Son Exposition Anatomique*.

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mining the Eye of M. *Bourdelote*, (Vide N. XVII.) the clouded Body, which was observed in the *Vitreous-humour*; and which *Brisseau*, and after him *Heister* concluded to be a *Glaucoma*, was nothing else, than the *Tunica-Aranæa* contracted, and no Doubt, a little offuscated too. To the same Cause, we assign what *Scheuchzer*, Physician of *Zurich* in *Switzerland*, relates (5) of a Woman, whose *Crystalin* was depressed; and upon examining this Eye after Death, the anterior Part of the *Vitreous-humour* was found thick and clouded.

XLVI. To the same it is, that we attribute, what *Morand*, the Son, gives to St. *Yves* (6), in relation to two *Cataracts*, which he depressed in a Soldier of the *Invalids*. In each

(5) *Acta Medico-physica Naturæ Curiosor*, Tom. III. Obs. 36.

(6) *Reponse à une lettre critique de M. Mouchard, contre son traité des maladies des yeux.*

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each Eye, he found the *Crystallin*, lodged under the *Vitreous-humour*; and this last convex in it's anterior Part. This (it's anterior Part) he found, covered with Specks of a whitish Colour, in each Eye; and those Specks he imagines might be occasioned by the Cicatrices of some Scratches, which the Needle might have made in the Operation. St. *Yves* thinks, those clouded Specks proceed only from *Cataracts*, which have been depreffed before full ripe; and so are hacked and cut to Pieces, in the Operation. Nor is he at all surprised, to find in operated Eyes, sometimes *Membranous-shreads*, which he attributes to the same Cause.

XLVII. It is a little surprizing, that three such great Men, as *Winslow*, *Petit* and *Merand*, who were at the Examination of the above Eyes, would not enquire more particularly

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ticularly into the Cause of them
 Opacities, which they observed in
 each Eye. Had the great *Winslow*,
 but remembered, the beautiful De-
 scription he gave of the *Cryſtalin-*
Membrane, it's Density, Blaſticity,
 &c. or *Petit* but recollected, the
 great and uſeful Discoveries he made,
 with reſpect to this *Capſula*, and it's
 contained Body, they would have
 quickly ſeen, the Cauſes of them
 opaque Bodies; by which Discovery,
 joined to their great Knowledge, in
 the Structure and Make of thoſe
 Parts, we ſhould perhaps ſee, this
 Operation, in greater Credit, than
 it now is. Since it is evident, from
 what has been already ſaid, (N.
 XXXIII. ad XL.) That, if a Me-
 thod was found out, to take away
 the *Capſula* with the opaque *Cryſta-*
lin, WE SHOULD SEE PRETTY NIGH
 AS WELL, AFTER THE OPERATION,
 AS IF NO SUCH DISORDER HAD EVER
 HAPPENED.

XLVIII. From the Structure of those Parts, such an Operation seems feasible, and not to be attended with any Danger. *First*, by a Discharge of Blood, which by disturbing the Humours, might destroy Sight; because the very fine Vessels, which the *Choroides* gives to the *Tunica Aranea*, contain but the serous Part of the Blood; so that wounding of them is not attended with the least ill Consequence. Nor is there more to be feared from the Blood-Vessel, which piercing the Eye, with the *Optick-Nerve*, spreads itself over the *Retina*; because, beyond the Middle of the *Vitreous-humour*, it's Expansions are but mere *Lymphaticks*.

XLIX. However, I must not omit mentioning, that I once shewed, the posterior Part of this Membrane entirely spread over, with Blood-Vessels.

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Vessels. They took their Rise, by some little Branches, from the *Ligamentum Ciliare*; and by others, from the Artery of the *Retina*; and uniting into one Trunk, ramified themselves differently, all over, the posterior Part (only) of this Membrane. I took off this Membrane with a great deal of Care, and Circumspection; and tho' I imagined, the *Crystalin-Lens* did not come out, with it's usual Facility; yet could I not conclude, from thence, that there was any Communication between the *Crystalin*, and it's Membrane; because, upon examining the former, even with a good Glass, I could not perceive any thing that seemed like a Blood-Vessel, in this Body.

L. The Method I took for this (and which I think is more certain, and occasions no Disputes, which it is imagined, Injections often do) was,

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was, by hanging a young Dog, by his hind Feet, to a Post: In about ten Moments after, I could perceive the Blood-Vessels of the Eye, become more manifest. I then got an Assistant, to hold his Head firm; and with a convex Needle, took up both the Jugulars. By this Means, the Blood was intercepted, in it's Return to the Heart; and of Consequence, all the Blood-Vessels filled up. The exact Figure of this Blood-Vessel, as it really appeared, I have caused to be engraved, in one of the Plates annexed to this Work. See *Plate II. fig. 5.*

LI. This Experiment, justly explains, a *Phænomenon*, which has been often treated of. People imagine, sometimes, that they see Hairs, or some opaque Bodies, swimming in the Air, which hide Part of an Object from them. To explain this Appearance, some have had Recourse to

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to Spots on the *Crystalin*, which refuse a Passage to the Light. But as it certain, that People who complain of this Disorder, have the *Crystalin* clear (for it is impossible, that there should be an Opacity in the *Crystalin*, without it's appearing so, to a Spectator) it is not a sufficient Reason. Others have had Recourse to too great a Dilatation of the Blood-Vessels, on some Part of the *Retina*. But as the *Retina* is always plentifully supplied, without any Inconvenience to Vision, we reject this Reason also. The posterior Part of the *Crystalin-Capsula*, in a natural State, receives it's Nourishment, by *Lymphatics*: If then it happens, that pure Blood is forced into them, in whatsoever Part it lies, so much of an Object, will be certainly hid from us. Nor is this Explication otherwise worth mentioning; but because it shews us, a Means to remedy
 this

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this Inconvenience ; which is, by plentiful Bleeding, in the Jugular-Vein, purging, and a diluting Diet, which lessen the Quantity, and attenuate the Viscidity of the Blood ; and so hinder the sanguineous Points from coagulating in those very slender Tubes.

L.H. In the *Nyctalopia*, the Patient is quite blind in the Day-time ; but towards Evening, begins to distinguish Objects ; and after Night-fall, sees pretty well. This *Phænomenon* may be thus explained : In the Day-time, the *Pupilla* is contracted, so that the Blood, which is forced into the *Lymphatick-Vessels*, and which principally spreads on the Center of the *Capsula*, stops a Passage to the Light ; but in the Night-time, when the *Pupilla* becomes more dilated, the Light passes thro' the Sides of the *Crystallin* ; and is the Reason why, such Per-

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sons see best in the Dark. But to this, I own, there may be an Objection made, which I cannot answer; nor would I have any one form a Method of Cure, from such a *Principle*, lest it might be erroneous. For, as the Contraction and Dilatation of the *Pupilla*, are in Proportion to the *Impetus*, which the Rays of Light impress, on the *Choroides-posterior*, it will consequently follow, that, when the Rays of Light cause no Sensation here, the *Pupilla* should be in a State of Inaction, that is, quite dilated (N. LXVII.) This I mention, to shew, how dangerous it is, to adhere to any Theory, how probable an Air of Truth soever it carries with it; more especially, when we would endeavour to make our Practice coincide with it.—But to our Subject.

LIII. Nor from the Parts, engaged in the Operation, is there more
to

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to be feared. It is true there is some Connexion, between the *Iris*, and *Vitreous-Membrane*, by Means of the Indentations of the *Processus-Ciliares*, on this Part. But it is to be observed, that those Notches are below the *Crystallin*; and even tho' they were not, yet if, what they call adherent *Cataracts*, are successfully separated from the *Iris* (see *Paré*, *Brisseau*, *Antoine*, &c.) without any dangerous Consequences ensuing; sure then, there is much less to be apprehended here.

LIV. But because the ingenious Dr. *Porterfield*, already mentioned, endeavours to shew, that the different-Figures which the Eye takes, is occasioned by the Attaches of the *Ligamentum-Ciliare* to the *Crystallin-Lens* (7); and of Consequence,

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that

(7) See also *Keplerus*, in his *Dioptricks*, *Martin*, *Pemberton*, *Gravesend*, and most Authors, who have wrote on this Subject.

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that People, after couching, have not that Facility of altering the Figure of their Eye, for different Objects. I observe, that there is not any Attaches between those two Bodies, more than what has been, already, taken Notice of, (N. XLVIII.) at least, by any Experiment that we can make. For, if you perforate the *Capsula*, and push out the *Crystatin-Lens*, it's Membrane immediately covers the *Vitreous-humour*; which sure, it could not do, were it any ways attached to the *Ciliary-Ligament*. Or, if, after stripping off the *Sclerotica*, you divide the *Oberoides* all round, below the *Ligamentum-Ciliare*, and pierce the *Aranæa*, so as entirely to separate this Membrane, from the *Vitreous-tunick*, and then push out the *Crystatin*, yet still you discover no Adherence.

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LV. But

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to LV. But because, to prove a Thing of this Consequence, a Man can never be too exact in his Experiments : I remark, that such an Adherence is quite impossible, from the different Situations of the *Crystallin-Lens* and *Ligamentum-Ciliare*. This last being, the posterior Part of the *Processus-Ciliares* ; which *Processus* cover, and in some Shape adhere to, the anterior Part of the *Vitreous-humour*, without touching the *Crystallin-Capsula* at all. If then the *Processus-Ciliares*, which are three or four lines nearer the *Crystallin*, than the *Ligamentum-Ciliare* is, have no Adherence to this Body ; with how much, then, less Appearance of Reason, can we suppose an Adherence, between it, and the *Ligamentum-Ciliare* ? And by which alone, we would pretend to explain the different Figures which the Eye takes.

LVI. As

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LVI. As then, Authors have not been sufficiently exact in their Description of this Adherence, between the *Sclerotica* and *Choroides*, which is very necessary for every Surgeon to know: I have found, by careful and repeated Dissections, that this Adherence does not rise, from the Border of the *Sclerotica*, round the Eye, at the Origin of the *Cornea-Transparens*; but that, in the Middle, and lateral Parts of the *Uvea*, there is, a full Line, in Distance, between the anterior Border of the *Sclerotica*, and the *Ligamentum-Ciliare*: And that here, the Adherence is a full Line in Breadth; when, on the Contrary, in the superior and inferior middle Parts of the Eye, it is just at the Border of the *Sclerotica*, and not above $\frac{1}{4}$ of a Line in Breadth. I have been the more exact in this Description, as it so essentially

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entially concerns the Operation. See *Plate I. and II.*

LVII. By this Account, it appears, that all the Figures, given of the Eye, have been faulty ; even that of *Petit's* (8) the most exact, is so. For, by looking over such Figures, we should imagine the *Iris* to be quite straight ; and to arise immediately from the anterior Edge of the *Sclerotica* : But if we look into a human Eye, we will find that the *Uvea* does not answer to the Description, which the Plates give us of it. For it appears, in the Eye, to be of a convex Figure ; and just adapted to the Parts contained within it ; and it's Convexity exactly to answer to the jeting-out of the *Cryſtalin*. Had Authors, but just considered this Circumstance only,

(8) Sa Lettre, dans laquelle il démontre, que le *Cryſtalin* eſt fort près de l'*Uvée*, &c.

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only, they would quickly have seen the Absurdity of even imagining, a Membrane to be formed here; whether from extravasated Matter, as St. Yves imagines; or from the Union of the more dense Parts of the *Aqueous-humour*, as the Antients supposed. This Circumstance *Aquependente* seemed well apprized of, where he declares, that it is impossible to pass the Needle, into the posterior Chamber of the Eye, without wounding the *Crystallin-Lens*; and this, long before it was imagined, that the *Cataract* was an Opacity of the *Crystallin*. It is on this Account, that I have caused three or four Cuts of the Eye, not, as it is generally represented, but as it really appears to be engraved, and joined to this Work.

CORROLARY. Hence it is manifest, that we should, not only see, as well after the Operation, as we formerly did;

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did; but also, that the Eye has the same Facility of altering it's Figure, according to the different Distances of the Things regarded; provided the Rays of Light have a free Ingress to the Bottom of the Eye.

LXVIII. Since then, there is not any Danger to be apprehended from the Structure of the Parts; and that their Situation also favours the Operation: General Evacuations, such as plentiful Bleedings, Purgings and Bathing being premised; as also, a spare, low Diet, for some Days before the Operation, to prevent Inflammation; having chose a clear serene Day, it may be done thus: The Needle may be made of the same Size, with the common Couching-Needle; with this Difference, that it should be quite flat, and edged, at it's Sides, as well as Point. The Eye should be pierced, about two Lines, and a Half, from the

K

Cornea-

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Cornea-Transparens, in the *Conjunctiva*, at the external Angle of the Eye; for if you pass the Needle, at Half a Line, or a Line's Distance, from the *Cornea*, as has been generally directed, you inevitably wound the *Ligamentum-Ciliare*. It is also safest, to pass the Needle in the Middle of the Globe, and not at all in the inferior Part of the Eye, as is practised by some; because, by this Means, you chance to wound one of the principal Vessels, which composes the *Vascular-Circle* of the Eye; they constantly piercing the *Sclerotica*, in two, or three different Places, in the same Line, in the superior and inferior middle Part of the Eye. It should enter horizontally, and pierce the *Crystallin-Membrane*, towards it's posterior Part; and continue the Separation of this Membrane, without in the least attempting to press on it's contained Body,

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Body, which might be apt to slip out too soon. This Membrane, being thus divided, you are then to depress both together under the *Vitreous-humour*. It is to be observed, that a *speculum oculi* here, far from expediting, rather hinders the Operation, by pressing on the Eye, and so, not giving sufficient Space for the Needle to move: 'Tis therefore, on this Account, justly condemned by *Heister*. But, it may sometimes happen, that the *Crystalin* may slip out, before the Division of the Membrane is perfected; and in this Case, you pierce the Membrane in it's Center, so as to divide it: And this you can the more easily do, your Needle being in the Middle of it, and so depress it, with the opacous *Crystalin*, or turn it over, to the contrary Side of the Eye, to which the Needle entered; and by this Means, your Operation will have the

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same Success, as if you precipitated both *Lens* and *Membrane* together.

LIX. But I am sensible, that several Objections may be made to this Operation: First, from the Attaches of the *Ligamentum-Ciliare*, to this Membrane; but I have evidently shewed, the Falsity of this Assertion at N. LIV, LV, LVI. It may also be objected, that in dividing this Membrane, the *Choroïdes* may be wounded in more than one or two Places; but as this Needle is edged, at it's Sides, those may continue the Separation of this Membrane, without in the least affecting that Body. But, granting it were wounded (which indeed may be sometimes the Case) need we be more apprehensive of a Wound of this Part only, than when we find both it, and the *Sclerotica* wounded together, without the least Danger? But then you'll say, the *Vitreous-Tunick*

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Turick may be, by this Means, wounded, and of Consequence, this Humour loosened; and Sight lost, as St. Yves (9) imagines. But it is to be noticed, that this is a pretty dense Body, which easily forms itself to the Part, which contains it: Nor will pricking it, in several Places, make it change it's Situation, which I have often tried, by placing it on my Hand. Nor is there any visible Membrane to cover this Body; for what surrounds it, is but a Sort of a Skin, which is nothing else but a Continuation of itself, in the same Manner, as the White of an Egg forms a Sort of Covering, when exposed to the Air.

LX. As for that Membrane, which covers the anterior Part of the *Vitreous-humour*, and surrounds the *Crystallin-Lens*, so as firmly to fix

(9) Les maladies des yeux, chap. xx.

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this Membrane in the *Vitreous-socket*; I imagine it to be, but, an Expansion from the *Processus-Ciliares*; because, beyond the posterior Part of those Notches, you cannot possibly separate it. I have often endeavoured to continue the Separation further, by putting it into different *Menstruum's*, examining it, without any previous Preparations, &c. but never could go any further. However, it would be very advisable in the Operation, to avoid wounding that Part of this Membrane, which covers the *Vitreous-Cavity*, than which, sure, nothing is easier.

LXI. Having then, I think, manifestly shewn, That the *Glaucoma* and *Cataract* are but different Names, to express the same Disorder by: That the Reason of the Unsuccessfulness of couching was not sufficiently known; and having shewn the true Reason of it, with a Method
by

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by which this Operation may be always certain, &c. I shall add, a Method of dissecting an Eye, by which, with one Eye only, you will see all the Parts of this wonderful Organ, *in situ naturali*; and which cannot be done by the Methods recommended by some (1).

LXII. With the Point of a Bistowry, or Lancet, you perforate the *Cornea-Transparens*; and then, by the Blade of a fine Scissors introduced, you entirely cut off this Part: And, as there is still sufficient Space, between the *Sclerotica*, and *Ligamentum-Ciliare*, you here apply a Forceps, by which Means, the Globe is not pressed, between the Fingers, nor any of it's Parts broke, or displaced. Then, with a fine Scalpel, you gently separate the *Ligamentum-Ciliare*, from it's Attaches to the

(1) Briggii *ophthalmographia*, p. 73. Cartesii *Dioptric. cap. v. &c.*

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the *Cornea opaca*, quite round the Globe of the Eye. Then, by passing one of the Blades of your Scissor, between the *Sclerotica* and *Choroides*, you divide this first, and will continue with your Scalpel, to separate any little Nerves or Arteries, which, by passing from one to the other, might continue the Adherence; and by this Means, you separate entirely the *Sclerotica* from the *Choroides*.

LXIII. By this Means, you will see all the Blood-Vessels, and Nerves, which are distributed to the *Iris*. The different Places, where they pierce the *Sclerotica*, glide between it's Intermices, and enter into the *Choroides*; particularly the two principal Branches, which compose *Haller's* Arterial-circle, which spread themselves round the *Iris*. These constantly pierce the Eye, in two, or three different Places, in the superior

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perior, and inferior middle Part of the Eye, in Men, as well as Brutes, as numberless and indisputable Experiments have satisfied me of. See *Fig. 1 and 2.* Then by continuing the Division of the *Choroides*, in the same Manner as that of the *Sclerotica*, you will see the *Retina*, as also, with Care, the *Canal Godronnée* of *M. Petit*, (2) the *Crystalin-Lens*, and *Vitreous-humour*, in their true Situation: The *Capsula* of the former; which, not only exists, but is also considerably denser, and firmer, than is generally imagined. By piercing this *Capsula*, you will see *Morgagni's Lymphatick Liquor* issue out; and by pressing a little harder on this Body, the *Crystalin* itself will slip thro' the Aperture. See *Fig. 4.*

L LXIV.

(2) *Memoires de l'Academie*, 1726.

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LXIV. The *Iris*, or more properly, the *Choroides anterior*, is always described to be composed of a double Row of muscular Fibres: Those which immediately surround the *Pupilla*, are orbicular; and the radial ones are, on one Side, attached to the orbicular Range of Fibres, and by the other, to the *Ligamentum-Ciliare*. The Use given to the Circular-fibres is, to contract the *Pupilla*; and those of the radial ones, to dilate it. The celebrated *Ruyfch* (in *Tbesauro, ejus Anatomica*) tho' he describes the *Iris* after this Manner, yet he freely owns, that the Circular-fibres are not at all distinct; and indeed justly too:

LXV. For, if you examine this Part with Care, you will find, but one Plan of Fibres, to wit, the Radial; for what gave rise to the Circular-fibres, was, that the Part of
the

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the *Iris*, which immediately surrounds the *Pupilla*, is thinner than the rest of this Body, and folded, as it were, in two or three Places, round the Circumference of this *Foramen*. But by carefully observing, with a good Glass, or even with the naked Eye, you will find those Fibres continue in straight Lines, thro' those Folds, from the Border of the *Pupilla*, to the grand Circumference of the *Iris*.

LXVI. But to put this Point entirely out of Dispute, it is to be noticed, that no Muscle (the Heart excepted) can act without a *punctum fixum*. To prove which, nothing can be more evincing than the following Experiment.

The anterior *Mastoiden-Muscles*, are, on one Side, attached to the Groove in the *Mastoid-Processus* of the *Os-Temporale*; and, on the

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other Part, to the superior internal Part of the *Clavicula*, and Top of the *Sternum*. Now the Use of those Muscles is, to bend the Head forwards; but this they only do in a horizontal Posture; because, in an erect Posture, the Head naturally bends forwards by it's Gravity. But as the *Sternum* is not a fix'd Point, by reason of the continual Elevation and Depression of the Ribs, the *Recti-abdominis*, which on one Part, are attached to the *Sternum*, *Cartilago Emiformis*, and two or three inferior true Ribs; and by the other, to the superior Part of the *Os-pubis*, are also in Action, at the same time, to raise up the Head, in this Posture. Without the Concurrence of which Muscles, in order to make a *punctum immobile* of the *Sternum*, we could not, in this Situation, raise our Heads. After this Proof, even granting there were such Fibres, yet, I believe, no one will say, that
they

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they could act different from, or independent of each other.

LXVII. The Action of this Part, may then, be thus accounted for. The *Pupilla*, in a State of Rest, is dilated: This is evident; because, whilst asleep, or in any State of Inaction, with respect to this Organ, we constantly find it so. When it contracts itself, the Eye becomes more oblong: The *Crystallin* and *Vitreous-humour* jet more forward, and so, by this Mechanism, we lengthen nigh Objects. And the true Reason, why we cannot see distinctly, at a less Distance than six Inches, is, because this Organ cannot form itself into an *Eliptical* Figure, sufficiently oblong, to catch their *Focus*. The *Pupilla* is dilated to view distant Objects; by which the Eye becomes more flat, and it's Bottom nigher the *Pupilla*. This is, not so much to let a greater Quantity

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Quantity of the Rays of Light in at once, as to endeavour to gather the Points of those Rays, which come from the Object we would endeavour to view, to fall on the Bottom of the Eye, in order to be transmitted to the *Sensarium commune*.

LXVIII. But, because Diversities of Opinions are apt to puzzle Readers; and that I have seen the Substance of a Paper, read before the *Royal Society* (3), wherein the Author endeavours to prove, that the Globe of the Eye, is constantly the same, on viewing all Objects, at different Distances; and that even it was necessary that the Eye should not change it's Figure, upon such Occasions; because, if it did, we could not judge of the Distance, or Propinquity of Objects. I own, the Thought to be very ingenuous; and could

(3) *London Magazine*, for July, 1749.

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could heartily wish, that it were as true as curious. But as it is certain, that the Eye does change it's Figure, which, I think, was never before called in Question ; and of Consequence, wanted not many Proofs. I must therefore, to support the Side of Justice, shew that it does. When we bring an Object insensibly from the Distance of good Sight, nearer the Eye, we observe the *Pupilla* imperceptibly to grow smaller ; and as the Image again recedes from it, to enlarge itself. Now neither of those Motions of the *Pupilla* can be done, without an Alteration in the Figure of the Eye ; therefore, when the *Pupilla* contracts itself, it does it by pulling the *Choroides anterior* forwards ; which necessarily makes the Eye become more oblong. When the *Pupilla* dilates itself, it does it by making the *Iris* more flat, and of Consequence, receding from the *Cornea*, and pressing

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sing back the other Humours ; by which it is manifest, that the Eye must become more flat. Nor do those Alterations in the Figure of the Eye, in the least hinder the Distinction of the different Distances of Objects : Thus, for Instance, when I hold an Object at about twelve Inches from my Eye, I see it distinctly ; yet as it gradually recedes from that Distance, I still see it ; but know, that it is at a greater Distance, by the Pains which I take to observe it, by my Eyes changing it's Figure. And tho' two Houses, of the same Magnitude, with respect to each other ; and at a considerable Distance, are seen by my Eye distinctly ; yet I know that one is nigher to me than the other, because it makes a larger Angle on the *Retina*.

LXIX. How those Changes, in the Figure of the Eye are made,
has

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has been Matter of great Contell.
 It has been generally believed, to be
 occasioned by the *Ligamentum-Ciliare*'s
 advancing, or retracting the
Cryſtalin; but this cannot be, be-
 cause the *Cryſtalin* has no Adherence
 to this Part. Others have imagined
 it to be done, by Means of the Elon-
 gation and Retraction of the *Cho-
 roides anterior*; but to this, there
 have been ſeveral Objections made;
 the moſt weighty of which is—
 If the Motions of the *Choroïdes an-
 terior*, by Means of it's Attaches to
 the *Ligamentum-Ciliare*, were the
 Cauſes of thoſe Changes in the Fi-
 gure of the Eye, we could not ſee
 Objects diſtinctly, but at two determi-
 ned Diſtances; that is to ſay, in the
 States of Contraction and Relaxation
 of this Part. But ſure this ſame
 Objection will hold good againſt
 thoſe who aſſign the Changes of this
 Organ, to the different Actions of
 it's Muſcles. As for me, I believe
 thoſe

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those Changes are made by the *Choroides anterior*; because the *Pupilla* is always contracted, at the same time, that the Eye becomes longer in it's *Axis*; and when the Eye becomes more flat, the *Pupilla* is dilated. Now, if these Changes in the Eye were occasioned by the Power of it's Muscles only; and of Consequence, that the *Choroides anterior* were a Body purely passive, it would necessarily follow, that when the Eye would become more oblong, the *Pupilla* should be dilated; because, being in itself without Motion, it should give Room to the Body pressing on it: And for the same Reason, it should contract itself, upon the Eye's becoming more flat; because it's Parts, by being flattened, or losing of their Convexity, should close each other. And as for the Action of a Muscle, I believe it has different Degrees of Contraction: Thus, for Instance, I cause

M

a strong

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a strong Man to strip the Arm bare, and extend it: Upon his bending the Fore-arm, I perceive the *Biceps* (which, by one of it's Tendons, is attached to the *Coracoide Apophysis* of the *Scapula*; and by the other, to the Groove in the superior Part of the *Humerus*; and uniting, form one strong Tendon, which is fix'd in the Tuberosity, in the Neck of the *Radius*) to swell: Upon causing him to lift up a large Book, I perceived it to grow much harder; and upon raising up a Chair, I feel it prodigiously hard and tense. By which it is manifest, that the Power of Action in a Muscle, is in Proportion to the Resistance of the Body; and that the Contraction of the *Pupilla*, is in Proportion to the Proximity of the Object regarded.

LXX. As then, the *Choroides anterior* is a musculous Part, which is constantly in Motion, we see how

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necessary it was, that it should be
 well supplied with Blood Vessels,
 and Nerves; therefore *Hewer's* Opi-
 nion, that those Blood Vessels sup-
 ply the Humours of the Eye with
 their Nourishment, cannot be true
 (4). I have very good Reasons to
 think that the *Aqueous-humour* is
 supplied by the *Choroidea posterior*,
 because, after you have discharged
 the *Aqueous-humour* of the Eye, if
 you take out this Membrane, and
 put it into Water, it immediately
 tinges it, as the *Aqueous-humour*
 would do. If you take it out of
 this, and put it into fresh Water, it
 gives it the same Appearance, and
 this it will continue to do, tho' you
 repeat it several times. From which
 we should not be surprized at the
 Facility, which this Humour has,
 upon being discharged to recover it-
 self again; nor can I find any Dif-
 ficulty, which is
 (4) De circulari humorum motu in oculis.

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faculty, in allowing, with *Mery*, this Humour to be secreted, by little glandular Points, placed in the *Ciloides posterior*.

LXXI. But this Assertion will still appear more evident, by an Example which the celebrated *Mery* gives, in the Works of the *Royal Academy*, for 1707, of a Woman, who died at the *Hôtel Dieu* of *Paris*, who had a *Glaucoma*, strongly adhering to the *Iris*, and which shut up the *Pupilla*. After he had taken off the *Cornea-transparens*, there did not issue out the least Drop of the *Aqueous-humour*: But when he had opened the other Coats of the Eye, posteriorly, this Humour discharged itself abundantly. *Hovius* has something in relation to a Cataractous-dog, in folio 85 of his Work, which seems to confirm this Opinion. This *Mery*, and who has been so often before mentioned, in this

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this Work, seems, by all Accounts, to have been the same, who was first Surgeon of *L'Hôtel Dieu*; and whose Criticism upon *Frère Jacques's* lateral Operation for the Stone (5); and his other Works are held in so much Esteem by the learned World. It is from this Piece, some would pretend (6), that the famous Mr. *Chefeldon* borrowed his lateral Operation.

LXXII. At the internal Angle of the Eye, near the *Caruncula-lachrymalis*, is a semilunar Fold, described only by the laborious *Winflow*; but I have found this Membrane, a Continuation of a Substance, partly cartilaginous and bony, which reaches almost to the Insertion of the *Optick Nerve*. From

(5) *Observations sur la manière de tailler, de Frère Jacques.*

(6) *Parallele des différentes manières de tirer la pierre, &c. fol. 133.*

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it's Origin, where it forms this semilunar Fold; it insensibly contracts itself, so as to form a very narrow Neck, of a firmer Substance; from whence it again enlarges itself, so as to form it's Body, or Belly, which as it augments in Bulk, encreases also in Firmness; and becomes of a bony Substance; which terminates a little more posteriorly than the Insertion of the *obliquus minor* Muscle; and exactly between it, and the *Rectus internus* in an oval Form. This Substance, which may be called *Os Opthalmicum*, or whatsoever other Name you think more expressive, forms internally (with respect to the Eye) a Concavity, which exactly answers to the Convexity of the Eye; and seems wonderfully to facilitate the Motions of this Organ; being in it's concave Part, lined by the *Tunica conjunctiva*, in which are here situated, several little Glands, visible enough, thro' which

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which an oily sort of Substance
 ouzes out. It seems to me, to re-
 ceive some fleshy Fibres, from the
Internus noster and *Obliquus minor*
 Muscles; and generally to answer
 to the Motions of the former. But
 as I can say nothing of Certainty,
 with respect to its Uses, I shall
 leave that to others: It is sufficient
 for me, thus to have faithfully de-
 scribed it.

LXXXIII. As I have made men-
 tion of *Havins*, in this little Trea-
 tise: I think it will not be amiss
 to give some Account of his Works
 here; more especially, as I see, se-
 veral quote him, who were not tho-
 roughly acquainted with his Wri-
 tings. He had taken his Degrees at
Utrecht in 1702, and took for his
 Doctorial Thesis, *An irregularis hu-
 morum motus in oculo?* This made
 a great Noise in the learned World,
 as well for the Newness, as the Singu-
 larity

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gularity of the Discovery : In 1716, he published it with large Amendments and Improvements, such as we now see it. As for the Dispute between *Ruyfch* and him, on Account of it, I have nothing to say, seeing, that he has published a long Letter in his own Justification. It is certain, that his Discovery of the Blood-Vessels in the *Eye* was very just ; yet I cannot help finding Fault with him, for concealing the Means he made Use of, for this Discovery : However, the Method I have successfully used ; and which is much more sure, and admits of less Disputes, than Injections, how fine soever, I have already described at N. L. and by the Help of something analogous to it, I have made more beautiful Injections in other Parts, than the most penetrating and complex Mixtures could do.

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LXXIV. The Antients supposed, the *Crystalin-Lens* to be formed by a Sort of Transudation from the *Vitreous-humour*: the *Aqueous-humour* the *Fæces* of the two former. *Hovius* thinks, that all the Humours of the Eye, are formed from the Blood-Vessels, which passing over the *Sclerotica*, are differently ramified thro' the Coats of the Eye. It was those Vessels, which *Nuck* imagined, supplied the *Aqueous-humour* of the Eye. (See *Plate I. Fig. 2.*) That Part which is spread over the *Choroides anterior*, he calls, *ductus oculi aquosus*. The *Crystalin* is a Texture of Nerves and *Lymphatics*, *Ad* and *Abductor's*, arising from the *Ligamentum-Ciliare*, and crossing each other in different Manners; and as it is entirely composed of *Laminae*, which separate by Water, *Hovius* thinks, each *Lamin* has an *Ab* and *Adductor* Vessel; that is to say,
one

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one which conveys it's Nourishment to it from the Blood, and that which returns it back again to the Heart. The *Vitreous-humour* receives it's Nourishment from the same Fountain; with this Difference, that these Vessels pass off in straight Lines, entering it at one Part, and leaving it at the other Extremity. Those Vessels rise chiefly from the *Ligamentum-Ciliare*; and others of them, from the little Ramifications of Blood-Vessels spread over the *Choroides*.

LXXV. As then each of these Humours has an *Adductor* Vessel, or one that brings it's Nourishment from the Heart; and an *Abductor*, or one that returns back, this Liquor again, it may be easily seen, that there is a continual Regeneration, and Circulation of the Humours in the Eye. That is, that in every *Systole* of the Heart, the Blood is thrown into

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the Vessels of the Eye, and by them equally expanded thro' all its Parts; and in every *Diastole* sent back by the Veins. Now, let us suppose a Dog, the Quantity of whose Blood to be a Pound; and granting, that no more than Half a Grain were thrown into the Eye, at every Contraction of the Heart. As the Heart has above two thousand Pulsations in an Hour, as *Harvey*, *De circulatione Sanguinis*, observes; and which *Lowerus* says, is the least. Now it is manifest, that in an Hour's Time, there cannot be less than one thousand Grains, or two Ounces, two Scruples; which in twelve Hours, is a Pound, nine Ounces; and consequently, in both Eyes, there is three Pounds, two Ounces, in that Space of Time. But that this Circulation might be more evident, I made an Aperture into the *Cornea*, and after the *Aqueous-hu-*
mour

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mour had discharged itself, I applied a Bottle to the Part; and besides, three or four Drops that were lost, there fell into the Bottle, twenty-three Grains, in twelve Moments time. Now, supposing a like Quantity to be fecerned, for the *Cryſtalin-Lens*, in the same time, and four times that Quantity for the *Vitreous-humour*, we shall find, in twelve Moments time, 156 Drops, or two Drams, one Scruple and sixteen Grains of Humours in each Eye. Now for a more evident Proof: If you tie the *Jugular-Vein*, the Eye immediately swells, because the Humours, which should be turned back, from the Eye, are here obstructed. But if you tie the *Carotid-Artery*, the Eye immediately becomes flaccid, and dull; because the Humours are hindered a Passage to it. From all which Experiments, it is evident, THAT THERE IS A CONSTANT CIRCULATION OF THE HUMOURS

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MOURS IN THE EYE.— Thus far
Hovius.

LXXVI. But granting, (as it certainly is) that the Blood-Vessels of the Eye have this constant Circulation, can we from thence infer, that the Humours have the same? As the Origin of them is, that Trunk, which separates into two or three Branches, at the posterior Part of the *Sclerotica*, by what Mechanism can it's Expansions separate Humours so different from each other? The minutest Canals, or Extremities of Arteries, separate the *Lymph*, yet those are Liquors, quite different from *Lymph*, and yet imagined to arise from and go to the Blood. It is certain, that the Blood secerns Liquors different from itself; as for Instance, the *Bladder*, *Urine*, the *Liver*, *Bile*, &c. But then it must be also granted, that these *Secretions* cannot be made, without the Interposition of some
glandular

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glandular Substance, such as the *Liver*, *Kidneys*, &c. But, with respect to the Eye, there are no such Substances, to seern these Humours from the Blood.

LXXVII. But to come closer to the Point : By this Experiment on the Dog, he would prove the Constancy of this Circulation, and Facility of the Regeneration of the Humours of the Eye, by shewing, that in twelve Moments Time, more Blood is thrown into the Eye, than all these Humours, put together, can weigh. But if a determined Quantity of Blood is thrown into the Eye, at every Contraction of the Heart ; consequently the same Quantity is returned back, at each Dilation of this Part. If then the *Aqueous-humour* be discharged, the Blood cannot be supposed to give so immediate a Repletion to this Part, without lessening the Quantity to the other

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other Parts; seeing that in an Hour's Time, the *Aqueous-humour* is again regenerated, as frequent Experiments prove. But the Reason why this Humour is so immediately formed, and why the *Iris* is so well stored with Blood-Vessels, I have already shewn at N. LXX.

LXXVIII. But this imaginary Circulation will be found still more weak, by the Remarks of *Petit* the Physician (7); who shews, that the *Crystallin-Lens* has no Communication with the adjacent Parts, either by Blood-Vessels, or otherwise. But to prove that the other Humours, have not this Facility of Regeneration, the Process of couching evidently shews; and I find nothing more pertinent to this Subject, than what the late learned Dr. *Molyneaux*, of *Dublin*, relates, in an elegant Latin.

(7) Memoires de l'Academie, 1730.

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Latin *Memoir*, given into the *Royal Society*, and printed in their Works, for 1730 (8). He tells of a Soldier of *Kilmainhim*, whose Eyes being *cataractous*, were both couch-ed : In about nine Years after, the Man died of an *Inflammatory-Fever*. Upon examining his Eyes, there was not found the least Remains of a *Crystalin* : From hence, he thinks, (as I do also) that after couching, the *Crystalin* insensibly wastes away, so as in Time, not to leave the least Mark of it behind. If then, Dr. *Hew's* Opinion were true ; it would consequently follow, that a new *Crystalin* should be formed, in about an Hour's time, after depressing the former.

LXXIX. But by his Instances of the Ligatures of the *Jugular-Vein* and
O *Carotid-*

(8) Philosophical Transactions, N. 384. p. 149.

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Carotid-Artery, he seems to make it unquestionable ; but if you will consider the following Remarks, you will find that those Experiments prove nothing for him : —

It is certain, that if you tie the *Jugular-Vein*, the *Blood-Vessels* of the Eye will be distended, because they cannot return their Contents to the Heart. It is equally true, that in tying up the *Carotid-Artery*, the Eye loses it's Briskness ; yet it is also as fact, that in both Experiments the Humours of the Eye, are, neither augmented, nor diminished in their Quantity. From hence then, it is manifest, THAT THERE IS NOT ANY CIRCULATION OF THE HUMOURS IN THE EYE.

LXXX. *Lewenhoeck* says (9), that the *Crystallin-Lens* is composed of exceeding fine Threads, or Fibres, crossing

(9) Philosophical Transactions, N. 293.

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crossing each other differently, and closely connected together ; without which, it were impossible for this Body to keep it's Transparency : *Hovius* seems to have borrowed his Description of it from him. But this Body itself may probably be formed, by this *Lymphatick* Liquor brought to it, by the Canal of the *Crystalin-Capsula* ; and it's different Degrees of Consistence, according to the different Ages of the Animal ; all which the learned *Petit* has elegantly described (1), seems to make it more than barely probable.

LXXXI. The black Substance, with which the *Choroides posterior* is lined ; and which I believe, with *Mery*, to be the Origin of the *Aqueous-humour*, M. *Le Cat* (2) very humourously accounts for, by
O 2 supposing

(1) *Memoires de l'Academie*, 1726.

(2) *Traité des Sens*, p. 378.

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supposing, that the *Sulphurs* of the Blood, being here, intimately mixt with the *Succus Nervorum*, which he imagines has some Analogy to *Quick-silver*, forms this Blackness; Or, *Mercury*, joined to *Sulphur*, forms a black Powder.

LXXXII. Had M. *Le Cat* examined human Eyes, as well as those of Brutes, he would have found the *Choroides* lined with a darkish Brown, instead of a black Substance. For, whatsoever be the Colour of the *Choroides*, so will that of the *Aqueous-humour* be; and therefore, it is black in Sheep and Calves, &c. and of a clear Brown in Men and Dogs, &c. Howsoever, this we may explain, according to his *Hypothesis*, by supposing the Eye to abound more with *Sulphurs* than *Mercury*; and therefore there is not sufficient of the latter, to blacken the *Choroides*: and this perhaps might be the Reason,

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son, that Sheep's Eyes are more sprightly than human ones. Such odd Notions it is, that makes so many voluminous Authors in Physick, and so little to the Purpose.

LXXXIII. By often considering how susceptible the Eye is to violent Inflammation, after precipitating the *Cataract*, and frequent Experiments on that Subject; I think, I have found out the true Reason of it, which no one has yet attempted; and which is of too interisting a Nature to be here omitted. The opaque *Crystalin*, after the Operation is generally placed, in the anterior and inferior Part of the Eye, between the *Processus-Ciliares* and *Vitreous-humour*. By this Means, the Artery of the *Iris*, already described, (N. LXIII) is compress'd: In Consequence of the Compression here, there is too great a Dilatation of

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of the Parts elsewhere. The Vessels on the *Choroides posterior* (which I believe, with *Mariotte* (3) to be the immediate Organ of Vision) are filled and distended: On this Account, the Rays of Light strike with too great an *Impetus*; Or, the weakest Light, at this Time, gives too sensible a Vibration to those Parts, already too much stretched. From this then the Pain, Inflammation, weeping of the Eye, &c. may be reasonably accounted for. This also, justly, explains, why the opaque Body, sometimes rises again, in consequence of this Inflammation. From all this, then, it will appear, how necessary it is, to make plentiful Evacuations, antecedent to the Operation, as already directed (N. LVIII.) It was for Want of those previous Preparations, that so few amongst the

(3) Ces nouvelles decouvertes, touchant la vue.

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the Number of Poor, which the *German* Oculist *Hillmer*, operated on, last Winter, in *London*, recovered their Sight. His Method was, any one who offered themselves to him, he immediately operated on, by striking his Needle into the Eye, as some are wont to do, in performing the Operation of the *Paracentesis*. By this Means, the Needle used to enter, sometimes at the Border of the *Sclerotica* ; at other Times, two or three Lines more posteriorly. But, besides this indecent Manner of operating, his Needle was very injudiciously contrived ; being just the Make and Size of a large Stocking-needle : By this Means, very often, after the Needle was passed into the Eye, the Opacity remained ; so that I have seen him, after turning his Needle backwards and forwards, in the Eye, for above six Moments, obliged to draw it out again, and the Opacity remain

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main behind. His Antagonist *Taylor* certainly knew more of the Eye, and was an excellent Operator; but *Hillmer* had two Advantages over him: One, in being a Foreigner; the other, in not speaking *English*. The only Application he made Use of, after the Operation, was, to moisten a Compress in a Mixture of the *Whites* of Eggs and Sugar of *Lead*, and so apply it to the operated Eye, and let Nature do the rest.

LXXXIV. *Taylor* always made Preparations, by *Phlebotomy*, *purg-
ing*, &c. previous to the Opera-
tion. The Needle he used was *Plano-Convex*. It's convex Part was marked by a black Line in the Handle. But if *Hillmer* made little Ceremony in performing the Opera-
tion, this was as much on the other
Extreme; insomuch that he would
be Half an Hour tying and untying
his

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his Garters, turning and winding his Ruffles, and accommodating himself for this grand Affair. But, because he pretended to have mighty Advantages by his Method of operating, I shall relate it at full Length, such as I have heard him describe, and seen him perform, above thirty Times.

LXXXV. General Evacuations being used, and the Day fixt for the Operation; after the Patient had been seated, and exposed to a proper Light, and the Doctor had also fixt himself: The Eye-lids being separated from each other, he fixt his *Speculum Oculi*, by which Means, the Eye was kept firm, and exposed for the Operation. He then, taking his Needle, with it's flat Part, next the Eye, and it's convex Part externally, pierces the Eye with it, exactly in this Position. The Needle
P enters

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enters the *Eye*, in it's inferior and lateral Part, towards the external Angle : He then gently elevates the Handle of the Instrument, enlarges the Aperture of the *Crystalin-Capsula*, in it's inferior Part, and thus precipitates the opaque Body. The Operation being over, the Eye is immediately closed, by a Compress dipt in Spirits of Wine, and R, the Patient bled in the *Jugular*, and ordered a Purge for the next Day.

LXXXVI. The great Advantages, which the *Doctor* promised himself by this Operation, were ; *first*, by this Means, he pretended to avoid wounding the *Ciliary-Nerves*; and of Consequence, very little of Pain or Inflammation were to be apprehended from the Operation : *Secondly*, were the *Crystalin* in a solid, or fluid State, it always occupied

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pied the anterior and inferior Part of the Eye, so that there was never any Fear of it's mixing with the other Humours, and of Consequence, of offuscating them. As for the Operation described on his Book (4) tho' he spends Time and Paper enough in shewing it, yet it is so confused, and at the same time, shews so little Knowledge of the real Situation of the *Crystallin*, and it's Attaches, that I have not thought fit once to mention it.

LXXXVII. But the Danger that is to be apprehended from this Operation, is more than an Equivalent for it's Advantages. *First*, from the Danger of wounding the inferior *Artery* of the *Eye*, from which Accident, the entire Loss of Sight

P 2 is

(4) Le mechanisme du globe de l'œil, p. 141, ad 167.

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is very much to be feared. And as to the *Ciliary-Nerves*, they enter into the *Ligamentum-Ciliare* at all Sides; so that it is impossible to avoid wounding them, whatsoever Way you operate. It is true, you very readily discharge the impacted Body by this Operation; but it is also as certain, that you will as readily and effectually do it in the Way I have described, even tho' you have not a Mind to take away the *Capsula*. And as for the *Speculum Oculi*, I have already observed the Disadvantages of it, at N. LVIII. As for *Hillmer's* Method, it is certainly very bad. For the Needle, which is small, piercing the *Capsula*, depresses the *Crystalin*, rather by dilacerating the Membrane, than any thing else. By this Means, also, the *Crystalin* is broke, and Part of it pushed into the *Aqueous-Chamber* of the Eye. In a Word, then, it
shews

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shews so little of the real Knowledge of the Structure of this Part, and of the Body itself, which should be taken away : Not to mention, that two Eyes are never wounded in the same Place ; because, instead of gently piercing the Coats of the Eye, he immediately strikes his Needle into them, that it needs no Words to condemn it entirely.

LXXXVIII. The Needle used by St. Yves (5) is flat and edged ; and with it he pierces the *Sclerotica*, at a Half, or at most, a Line's Distance, from the *Cornea-Transparens* : But by this Means, not only the *Ligamentum-Ciliare* is wounded ; but also the *Processus-Ciliares*, which he would endeavour to avoid, are certainly touched, by the Directions which

(5) Les maladies des yeux, chap. xx.

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which he gives. *Heister's* Needle (6) is *Plano-Convex*, and with it, he pierces the Eye, at about two Lines distance from the *Cornea*: The same Method is used by *Brisseau*. *Petit* the Physician (7) perforates the Eye, at about two Lines and a Half from the *Cornea*, as I have directed. But he also owns, that the *Crysalin-Capsula* has an Adherence to the *Ligamentum-Ciliare*: And this Assertion the more surprized me, seeing that he took upon him particularly to describe the true Situation of the *Crysalin-Lens*, and this Body, in answer to some Remarks on the *Cataract*, given by *M. Hecquet*, in his *Traité des Amares* (8). Professor *Ferren's*

(6) *Tract. de Cataractâ*, p. 298. *Tract. ejus Chirurg.*

(7) *Memoires de l'Academie*, 1726.

(8) Sa lettre, ou il demontre, que la *Crysalin*, &c.

Letre des reflexions, &c.

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Ferren's Directions for this Operation are pretty nigh the same with *Petit's*.

LXXXIX. I think I cannot conclude this Work, without making some Remarks on the Operation of an imperforated *Iris*, or *Artificial Pupilla*, as described in the Works of the *Royal Society* (9); and from thence, by *Mr. Sharp*, in his Surgery, seeing that the Subject I have treated on, requires I should take Notice of it. I think then, that the Operation is very possible to be done, but that any Benefit should accrue from it, I think to be absolutely *impossible*; and that for the following Reasons. *First*, it is impossible, to pass the *Iris Needle*, between the *Crystallin-Lens*, and *Uvea*, without wounding the former:

(9) Philosophical Transactions, for 1730.

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mer : If then there is little or no Space between them in the natural State of the Eye, there must be still less, when this Part is compress'd by a *Speculum oculi*, which by the Author is deemed absolutely necessary in this Operation. *Secondly*, if the *Crysalin-Lens* be wounded, an Opacity will be necessarily formed in Consequence of the *Solution of Continuity* in this Body. Of this I saw a remarkable Instance in a Shoemaker's Boy in *London*, this last Winter, who had wounded the *Crysalin*, by an Awl's piercing the *Cornea* ; and which Opacity Dr. *Taylor* removed in *Exeter-Change* in about ten Days after.

XC. But lest I should seem to prejudice the World against this Method, or lessen the Weight of the celebrated Author's Account of *Vision*, &c. in that *Memoir*, Truth obliges

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obliges me to declare, that the Patient might see immediately after the Operation, and so far his Accounts were certainly true; because, tho' the *Crystalin* were wounded, yet the Parts would keep their Transparency for some time, by Means of this *Lymph*, which surrounds the *Crystalin*; as for Instance, an Hour or two; yet still, that the Patient should reap any further Advantages by it, is, what I absolutely deny. Howsoever, his imagining such an Operation, which the supposed Situation of those Parts, seemed to countenance, (there being always supposed to be a considerable Space, between the *Choroides anterior* and *Crystalin-Lens*, which was filled up with the *Aqueous-humour*) deserves Applause.

XCI. If then, at any time, this Operation, (which may properly
Q enough

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enough be called *Koreotomy* (1), seeing that we are so fond of *Greek Terms* may succeed, it seems to bid fairest for it, when done thus. The Patient being prepared by *Venesection*, &c. he should seat himself before a good Light, in the same Manner, as if for couching. Then the Surgeon should apply the *Speculum Oculi*, to fix the Eye firm; and with a *Cataract*, or *Iris Needle*, perforate the *Cornea-Transparens*, in it's inferior Part. The Needle should enter obliquely; and when you perceive it has entered thro' this Coat, you should lessen the Pressure of the *Speculum*, without entirely removing it; and then gently perforate the *Iris* in it's Center, and then draw out your Needle, and remove the *Speculum Oculi*. The Eye should be closed, and every other Circumstance

(1) *Ακίνη Pupilla, et σίμων secare.*

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stance observed, as if for depressing a *Cataract*: And by this Method only, you may perform such an Operation, without wounding the *Cryſtalin-Lens*.

An

Of the CATARACT 115

stance observed, as if for describing
a Cataract: And by this Method
only, you may perform such an Opera-
tion, without wounding the Eye.
The Patient being prepared, and
the Surgeon seated, he should hold his
finger and thumb, in such a Manner
as to keep the Eye firm; and with
the Needle, he should pass it into the
Cornea, and then into the Chamber
of the Eye. The Needle should be
inserted obliquely; and when you per-
ceive it has entered the Chamber,
you should then the Point of the
Needle, without any further
force, and then gently perform the
Operation. The Eye should be
kept firm, and every other Circum-
stance should be managed as in the
Operation of the Cataract.

PLATE I

FIG. I

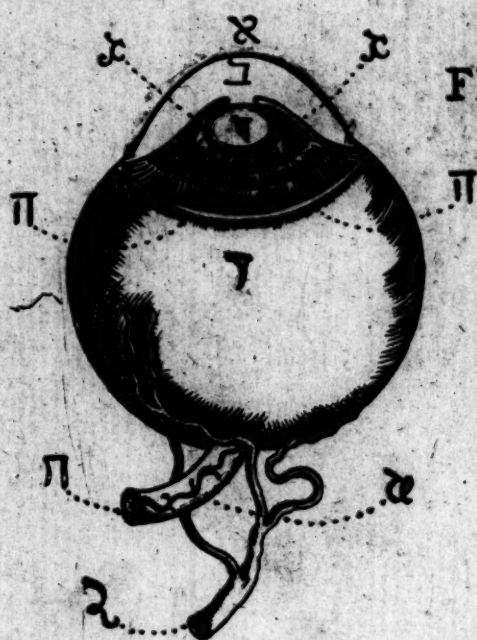
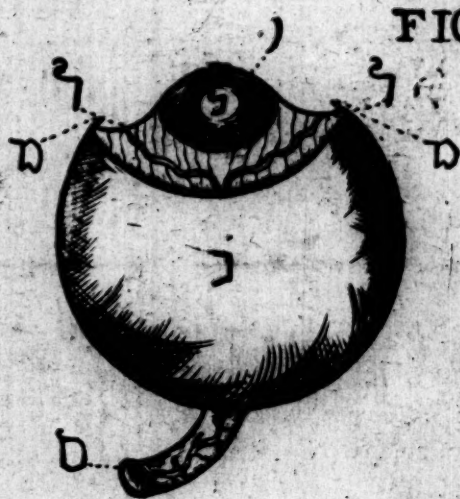


FIG. 2



An EXPLANATION of
PLATE the I. FIG. 1. and 2.

FIGURE the 1st.

1. The *Cornea-Transparens*.
2. That Space between the *Cornea* and *Choroides anterior*, commonly called the *anterior Chamber* of the *Aqueous-humour*.

3. The *Uvea*, *Iris*, or *Choroides anterior*.

4. The *Cryſtalin-Lens*, as it appears, on taking off the *Cornea*.

5. The *Ligamentum-Ciliare*.

6. The *Sclerotica*, being the first of the three Membranes, in which the Humours of the Eye are contained.

7. The principal Trunk, from which the Eye receives it's Blood-Vessels; taken from *Hovius*.

8. The *Optick-Nerve*.

9. An *Artery*, which, twining round the *Optick-Nerve*, pierces it, and so ramifies itself on the *Retina* and *Vitreous-humour*.

FIGURE

FIGURE the 2d.

1. The *Choroides anterior*.
2. The *Crystallin-Lens*.
3. The *Arterial Circle* of the *Choroides anterior*: The single Strokes, ascending and descending from it, shew the Ramifications of lesser Vessels proceeding from it.
4. The *anterior Border* of the *Sclerotica*, where the *Cornea-Transparens* begins, rising more anteriorly than the *Choroides anterior*: The Space between it, and the *Iris*, shews the Distance there is between the Beginning of the *Sclerotica*, and *Ligamentum-Ciliare*.
5. The *Sclerotica*.
6. The *Optick-Nerve*.

PLATE 2

FIG: 3

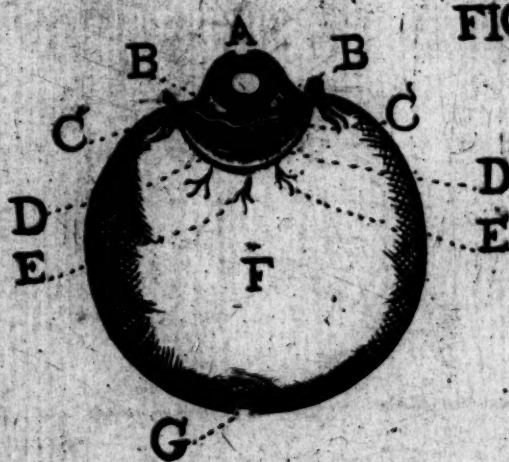
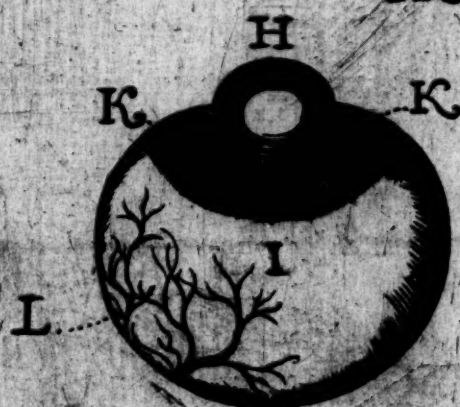


FIG: 5



FIG: IV



An EXPLANATION of
PLATE the II. FIG. 3, 4,
and 5.

FIGURE the 3d.

A. The *Pupilla*.

B. B. The *Iris*, or *Choroides anterior*.

C. C. The *Vascular-circle* of the *Iris*: The three Threads, which enter into the *Ligamentum-Ciliare*, and form this Circle, are the *Ductus Aquosi* of *Nuck*, and which pass from the *Sclerotica* to the *Choroides*, exactly as marked here.

D. D. The *Ligamentum-Ciliare*, truly delineated.

E. E. are little *Blood-Vessels*, and *Nerves*, which are dispersed round the *Ligamentum-Ciliare*, and arising chiefly from the *Sclerotica*.

F. The *Choroides posterior*.

G. Part of the *Retina*.

FIGURE

FIGURE the 3th.

*. The just Figure of the different Ramifications of a *Blood-Vessel*, which spread itself over the posterior Part of the *Crystalin-Capsula*. — See N. XLIX.

FIGURE the 4th.

H. The *Crystalin-Lens*, contained in it's *Capsula*, and lodged in the Cavity of the *Vitreous-humour*, to which it is fix'd by the Continuation of it's *Membrane*, having it's Rise from the *Ligamentum-Ciliare*.

I. The *Vitreous-humour*.

K. The *Coronæ-Ciliares*, or Indentations of the *Processus-Ciliares*.

L. The Distribution of a *Blood-Vessel*, on the *Vitreous-humour*.

F I N I S.

